SPECIAL PUBLICATION ARCCB-SP-95037

INDEX TO BENET LABORATORIES TECHNICAL REPORTS - 1994

R. D. NEIFELD

AUGUST 1995



US ARMY ARMAMENT RESEARCH, DEVELOPMENT AND ENGINEERING CENTER

CLOSE COMBAT ARMAMENTS CENTER BENÉT LABORATORIES WATERVLIET, N.Y. 12189-4050



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1. AGENCY USE ONLY (Leave black		RT DATE	3. REPORT TYPE AN	D DATES	COVERED
August 1995 Final 4. TITLE AND SUBTITLE INDEX TO BENET LABORATORIES TECHNICAL REPORTS - 1994			5. FUND N/A	ING NUMBERS	
6. AUTHOR(S)				1	
R. D. Neifeld					
7. PERFORMING ORGANIZATION N U.S. Army ARDEC Benet Laboratories, AMSTA-AR-C Watervliet, NY 12189-4050		ADDRESS(ES)	· ·	REPO	ORMING ORGANIZATION RT NUMBER CB-SP-95037
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9. SPONSORING / MONITORING AG U.S. Army ARDEC Close Combat Armaments Center Picatinny Arsenal, NJ 07806-5000	ENCY NAME(S) AND ADDRESS(ES	·)		SORING/MONITORING ICY REPORT NUMBER
11. SUPPLEMENTARY NOTES		:			
12a. DISTRIBUTION / AVAILABILITY	STATEMENT		· · · · · · · · · · · · · · · · · · ·	12b. DIS	TRIBUTION CODE
Approved for public release; distrib	oution unlimited	d.			
13. ABSTRACT (Maximum 200 words)					
This is a compilation of technical r	eports publishe	d by Benet Laborate	ories during 1994.		
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14. SUBJECT TERMS Benet Laboratories, Technical Publ	ications, Biblio	graphies, Abstracts,	Document Control Data		15. NUMBER OF PAGES 74 16. PRICE CODE
17. SECURITY CLASSIFICATION OF REPORT UNCLASSIFIED	18. SECURITY OF THIS I UNCLASSIFIE		19. SECURITY CLASSIF OF ABSTRACT UNCLASSIFIED	ICATION	20. LIMITATION OF ABSTRACT UL

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ARCCB-TR-94048	A292 440
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1. AGENCY USE ONLY (Leave blank)	2. REPORT DATE	3. REPORT TYPE AN	D DATES COVERED	
	January 1994	Final		
4. TITLE AND SUBTITLE SIMPLER J. TEST AND DATA ANA PROCEDURES FOR HIGH STRENGT 6. AUTHOR(S) J.H. Underwood, E.J. Troiano, and R.T.	TH STEELS	·	5. FUNDING NUMBERS AMCMS No. 6111.02.H610.011 PRON No. 1A11Z1CANMBJ	
7. PERFORMING ORGANIZATION NAME U.S. Army ARDEC Benet Laboratories, SMCAR-CCB-TL Watervliet, NY 12189-4050	(S) AND ADDRESS(ES)		8. PERFORMING ORGANIZATION REPORT NUMBER ARCCB-TR-94001	
9. SPONSORING/MONITORING AGENCY U.S. Army ARDEC Close Combat Armaments Center Picatinny Arsenal, NJ 07806-5000	Y NAME(S) AND ADDRESS(ES		10. SPONSORING / MONITORING AGENCY REPORT NUMBER	
11. SUPPLEMENTARY NOTES Presented at the 24th National Sympos Published in Proceedings of the Sympo		atlinburg, TN, 30 June-2	July 1992.	
12a. DISTRIBUTION / AVAILABILITY STA	TEMENT		12b. DISTRIBUTION CODE	
Approved for public release; distribution				
13. ABSTRACT (Maximum 200 words)				
Tests of five medium and high strength steels were used to investigate some prospective simplifications in $I_{\rm L}$ test and data analysis procedures. Three-point bend specimens with material strengths of 500 to 1500 MPa and nominal thickness of 10 mm were tested at room temperature. The investigation included (1) $I_{\rm L}$ tests using measured crack-mouth displacement to calculate load-line displacement based on an expression that relates the two displacements; (2) a simple zero-point adjustment for J versus Δa curves, whereby certain intermediate Δa values are shifted to the blumting line to correct for errors at low values of Δa; and (3) a comparison of Δa and $I_{\rm L}$ results from the load-drop method, which gives a simple measure of crack growth after maximum load, with results from the usual unloading compliance method. The various results and comparisons are discussed in relation to their usefulness as a general $I_{\rm L}$ test procedure for a variety of materials, or a limited use test for certain materials. Two specific test and data analysis procedures are proposed for general use in $I_{\rm L}$ testing, as follows: (1) A new expression is described that calculates load-line displacement for the bend specimen from measured crack-mouth displacement, for a range of a/W values and strain-hardening exponents. The expression makes possible a single-displacement unloading compliance				
I_L test for the bend specimen, using a single, standard, crack-mouth clip gage. (2) A simple zero-shift procedure is proposed for general use with I_L tests and for addition to ASTM Method E-813. The procedure adjusts the zero point of Δa so that on average the Δa values lie on the blunting line over the J-range of 20 to 60 percent of the provisional fracture toughness, I_Q . The adjustment calculations can be done with a calculator or a few lines of computer code.				

17. SECURITY CLASSIFICATION
OF REPORT
UNCLASSIFIED

18. SECURITY CLASSIFICATION OF THIS PAGE UNCLASSIFIED

J-Integral Fracture Toughness, Fracture Mechanics, High Strength Steel, Crack-Mouth Displacement, Unloading Compliance, Three-point Bend Specimen

19. SECURITY CLASSIFICATION OF ABSTRACT UNCLASSIFIED

20. LIMITATION OF ABSTRACT

UL

14. SUBJECT TERMS

15. NUMBER OF PAGES

16. PRICE CODE

Form Approved OMB No. 0704-0188

Public reporting burden for this collection of information is estimated to average 1 hour per response. Including the time for reviewing instructions searching existing dark currents of this dark meded, and completing and reviewing the collection of information. Send comments regarding this durden estimate or any little series.

collection of information, including suggestions for Davis Highway, Suite 1204, Arlington, VA 22202-430	reducing this burden, to Washington Head 2, and to the Office of Management and B	lquarters Services, Directorate for udget, Paperwork Reduction Proji	information (Deerstins) Fra Reducts, 1215 Jemerson ect (0704-0188) Mashington (DC 17503)
1. AGENCY USE ONLY (Leave blank)	2. REPORT DATE	3. REPORT TYPE AND	D DATES COVERED
	January 1994	Final	5. FUNDING NUMBERS
4. TITLE AND SUBTITLE CURVATURE-INDUCED MOT PHASE II: MODELLING	TONS OF 60-MM GUNS		PRON: M139Q199M11A AMCMS: 61262411180000
6. AUTHOR(S)			
Ronald G. Gast			
7. PERFORMING ORGANIZATION NAM	E(S) AND ADDRESS(ES)		8. PERFORMING ORGANIZATION REPORT NUMBER
U.S. Army ARDEC Benét Laboratories, SMCAR-CC Watervliet, NY 12189-4050	B-TL		ARCCB-TR-94002
9. SPONSORING/MONITORING AGEN	CY NAME(S) AND ADDRESS(ES)	10. SPONSORING MONITORING
U.S. Army ARDEC Close Combat Armaments Cente Picatinny Arsenal, NJ 07806-5000	r		AGENCY REPORT NUMBER
11. SUPPLEMENTARY NOTES			
12a. DISTRIBUTION / AVAILABILITY ST	ATEMENT		12b. DISTRIBUTION CODE
in tank cannons during ballistic of muzzle's kinematic state may conloading the bore profile of the greffect on gun motions, a similar flexure, etc.) cannot be made. This lack of data was the driving simulations to study these relation previously. In the current phase regarding load functions for beam mimic test results very well, thus is apparent that the tubes model to the process.	requests for this document next Research, Development, a ies, SMCAR-CCB-DC, Water been made regarding the ident peration. These motions infrin in the itself. While curvature claim in regard to center line very little testing or modelling g force behind the developments of this investigation, the model of this investigation, the model of this investigation, the model are not dynamically similar ssing the most curvature is greater and the modelling results can be stablished as the model in the modelling results can be stablished as the modelling results can be stablished as the model in the modelling results can be stablished as the model in the model i	nust be referred to and Engineering viiet, NY 12189-4050. iffication of the dominan ge upon shot accuracy be aded flight path. A more e-induced loads due to profile produced by others been conducted to the ent of a set of controlle to 60-mm gun tubes with the lelling aspects are addrespects of curvature estimate that the laboratories' Uniform with regard to their transacter than and more sense.	t loads that cause beam-type vibrations ecause at projectile disengagement the re subtle point involves the sources of gravity droop are known to have little er conditions (manufacturing, thermal establish the severity of this condition. ed laboratory tests and the modelling a different profiles have been reported issed. The mathematical relationships attions are presented. These simulations in Segments Gun Vibration Model. It is segments of the segments of the segments of the sitive to orientation than the straighter itentation have a significant effect upon
			15. NUMBER OF PAGES
14. SUBJECT TERMS Gun Vibration, Vibration Mode	lling, Modal Analysis, 60-mm	Guns, Gun Accuracy,	32
Bore Curvature Sensitivity, Non-	uniform beam vibration Mod	леншЯ	16. PRICE CODE
17. SECURITY CLASSIFICATION 18 OF REPORT	SECURITY CLASSIFICATION OF THIS PAGE	19. SECURITY CLASSIF OF ABSTRACT	1
UNCLASSIFIED	UNCLASSIFIED	UNCLASSIFIED	
NSN 7540-01-280-5500	2	6	Standard Form 298 Rev. 2-89) Prescribed by ANSI Stal 233-18 298-102

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OMB No. 0704-0188

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4. TITLE AND SUBTITLE	January 1994	Final	NDING NUMBERS
		5. FU!	ADING NOWREKS
A REVIEW OF WELDMENT FA			MCMS No. 6126.24.H180.000
AND WELDABILITY TESTING	METHODS	P	RON No. 1A12ZW22NMBJ
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6. AUTHOR(S)			
6 W			
George Young			
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7. PERFORMING ORGANIZATION	NAME(S) AND ADDRESS(ES)	0 05	REORMING ORGANIZATION
· ·	MANINE(S) AND ADDRESS(ES)		ORT NUMBER
U.S. Army ARDEC			
Benet Laboratories, SMCAR-CCB	-TL	A	RCCB-TR-94003
Watervliet, NY 12189-4050			
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9. SPONSORING/MONITORING A	GENCY NAME(S) AND ADDRESS(ES		ONSORING / MONITORING
TV G A ADDEG		AC	ENCY REPORT NUMBER
U.S. Army ARDEC		į	
Close Combat Armaments Center			;
Picatinny Arsenal, NJ 07806-5000			
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11. SUPPLEMENTARY NOTES			
11. SUPPLEMENTARY NOTES			
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12a. DISTRIBUTION/AVAILABILITY	STATEMENT	12b. 0	ISTRIBUTION CODE
Approved for public release; distri	bution realisated		
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13. ABSTRACT (Maximum 200 woi	rde)		
13. ABSTRACT (Maximum 200 Words)			
An engineering study was conduct	ed that reviewed typical weldment f	silves modes and the times of we	debility test procedures commuter
used to predict behavioral response	of a material that is to be welded. I	n comparing the design effectives	ass of these tests, each has come
inherent technical advantages/disag	iventeges essociated with it. The te	it comparing the design effectively	annield time and costs accorded
inherent technical advantages/disadvantages associated with it. The tests, if used appropriately, can save untold time and costs associated with poorly welded structures/components that fail in service prematurely. They are divided into two major categories, direct and indirect,			
related to the test methodology or r	procedure used to generate results. Sprocedure	posifically direct tests make use o	for categories, direct and indirect,
tests utilize besic metallurgical pri	nciples to predict weld behavior. From	pecifically, direct tests make use o	t that determining what the many
annengiate weldshility test proced	lure is for obtaining useful results for	on and study, it should be appared	a success of that test
appropriate welconting and proceed	and a for obtaining ascial results it	a given situation is critical to u	te success of that test.
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14. SUBJECT TERMS			15. NUMBER OF PAGES
Weldability, Hot Cracking, Cold Cracking, Heat-Affected Zone			23
			16. PRICE CODE
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17. SECURITY CLASSIFICATION	18. SECURITY CLASSIFICATION	19. SECURITY CLASSIFICATION	20. LIMITATION OF ABSTRACT
OF REPORT	OF THIS PAGE	OF ABSTRACT	20. EINITE TON OF ABSTRACT
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OMB No. 0704-0188

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1. AGENCY USE ONLY (Leave blan	nk) 2. REPORT DATE	3. REPORT TYPE AND	DATES COVERED	
	February 1994	Final		
4. TITLE AND SUBTITLE A REVIEW OF RADIAL FORGI PREFORM DESIGN FOR PROCI	NG TECHNOLOGY INCLUDING ESS OPTIMIZATION	,,	FUNDING NUMBERS Contract DAAA22-89-M-0081	
6. AUTHOR(S)				
Joseph P. Domblesky, Rajiv Shivp Taylan Altan	ouri, and	·		
7. PERFORMING ORGANIZATION N NSF Engineering Research Center for Net Shape Manufacturing The Ohio State University Columbus, Ohio 43210		8	PERFORMING ORGANIZATION REPORT NUMBER	
9. SPONSORING/MONITORING AG	ENCY NAME(S) AND ADDRESS(ES)	1	0. SPONSORING / MONITORING	
U.S. Army ARDEC Benet Laboratories, SMCAR-CCB Watervliet, NY 12189-4050			AGENCY REPORT NUMBER ARCCB-CR-94004	
11. SUPPLEMENTARY NOTES Charles Calderone - Benet Labora	tories Project Engineer			
12a. DISTRIBUTION / AVAILABILITY	STATEMENT		2b. DISTRIBUTION CODE	
Approved for public release; distri				
13. ABSTRACT (Maximum 200 word	ds)			
The Engineering Research Center for Net Shape Manufacturing (located at Ohio State University, Columbus, Ohio) was contracted by Benet Laboratories to investigate the rotary forging operation at Watervliet Arsenal. They were asked to make recommendations on how to optimize the shape and size of the starting material (preform) prior to forging which would reduce or eliminate variations in mechanical properties along the length of the resulting forging. Based on the data supplied by Benet Laboratories, the study resulted in recommendation of a two-step preform design. This was a preliminary recommendation and further testing was suggested to separate the effects of forging reduction from post-forging heat treatment.				
14. SUBJECT TERMS			15. NUMBER OF PAGES	
Deformation Zones, Forging Reduction, Heat Treatment, Mechanical Properties,			106 16. PRICE CODE	
17. SECURITY CLASSIFICATION	18. SECURITY CLASSIFICATION	19. SECURITY CLASSIFICA	TION 20. LIMITATION OF ABSTRACT	
OF REPORT UNCLASSIFIED	OF THIS PAGE UNCLASSIFIED	OF ABSTRACT UNCLASSIFIED	UL	

Form Approved
OMB No. 0704-0188

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1. AGENCY USE ONLY (Leave bla	ink) 2. REPORT DATE	3. REPORT TYPE AND DATES COVERED	
	February 1994	Final	
4. TITLE AND SUBTITLE DETERMINATION OF THERMA OF 120-MM TANK AMMUNITION		5	AMCMS No. 6126.24.H180.000
6. AUTHOR(S)			
Karol Anne Liu Madulka, Eugene	Coppola, and John Kenna		
7. PERFORMING ORGANIZATION N	NAME(S) AND ADDRESS(ES)	8	PERFORMING ORGANIZATION
U.S. Army ARDEC Benet Laboratories, SMCAR-CCB Watervliet, NY 12189-4050	P-TL		ARCCB-TR-94005
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9. SPONSORING/MONITORING AC	SENCY NAME(S) AND ADDRESS(ES	5) 1	0. SPONSORING / MONITORING
U.S. Army ARDEC Close Combat Armaments Center Picatimny Arsenal, NJ 07806-5000			AGENCY REPORT NUMBER
11. SUPPLEMENTARY NOTES			
12a. DISTRIBUTION / AVAILABILITY	STATEMENT	1	26. DISTRIBUTION CODE
and specific authority; February 19 referred to Commander, U.S. Arm	mment Agencies only because of p 994. Other requests for this docum by Armament Research, Development es, SMCAR-CCB-DC, Watervliet, 1	nent must be ont, and Engineering	
13. ABSTRACT (Maximum 200 wor	ds)		
varying ambient temperature. The technical objective of the program ambient temperature conditions.	is report describes the test proced n was to determine the thermal res	ure, results of the test, and p ponsiveness (in terms of times to document program effort	rounds were measured as a function of preliminary conclusions. The primary to of 120-mm tank rounds to varying s. This report provides a reference for
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14. SUBJECT TERMS			15. NUMBER OF PAGES
Thermal Emulator, 120-mm Tank Ammunition, Thermal Responsiveness, Instrumented Rounds, M1A1 Tank			16. PRICE CODE
17. SECURITY CLASSIFICATION OF REPORT	18. SECURITY CLASSIFICATION OF THIS PAGE	19. SECURITY CLASSIFICA OF ABSTRACT	TION 20. LIMITATION OF ABSTRACT
UNCLASSIFIED	UNCLASSIFIED	UNCLASSIFIED	UL

Form Approved
OMB No. 0704-0188

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2. REPORT DATE

3. REPORT TYPE AND DATES COVERED

1. AGENCY USE ONLY (Leave blank)	2. REPORT DATE	3. REPORT TYPE A	ND DATES C	DVERED
	February 1994	Final		IC NUMBERS
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s. AUTHOR(S)			-	
Raymond Scanlon and Mark Joh	nson			
. PERFORMING ORGANIZATION NAM	IE(S) AND ADDRESS(ES)		8. PERFOR	RMING ORGANIZATION T NUMBER
U.S. Army ARDEC				
Benét Laboratories, SMCAR-CC Watervliet, NY 12189-4050	CB-TL		AR	CCB-TR-94006
	AND ADDRESSES		10 SPON	SORING / MONITORING
. SPONSORING/MONITORING AGEN	CY NAME(S) AND ADDRESS(ES)		AGEN	CY REPORT NUMBER
U.S. Army ARDEC Close Combat Armaments Cente Picatinny Arsenal, NJ 07806-5000				
11. SUPPLEMENTARY NOTES				
12a. DISTRIBUTION / AVAILABILITY ST	ATEMENT		12b. DIS1	RIBUTION CODE
iza. Distribution / Articality			İ	
Approved for public release; dist	tribution unlimited			
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13. ABSTRACT (Maximum 200 words) The vertebrate brain is explained to proceed without a homunculum	as an assemblage of neurons, ea	ch responsive only to	those afferen	t upon it. Thought is shown
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				45 AUG 100 05 04 655
14. SUBJECT TERMS Brain, Vertebrate, Homeostat, T	Thinking			15. NUMBER OF PAGES 25
				16. PRICE CODE
17. SECURITY CLASSIFICATION 11	8. SECURITY CLASSIFICATION OF THIS PAGE	19. SECURITY CLASS OF ABSTRACT	SIFICATION	20. LIMITATION OF ABSTRA
UNCLASSIFIED	UNCLASSIFIED	UNCLASSIFIE	D	UL.

Form Approved
OMB No. 0704-0188

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1. AGENCY USE ONLY (Leave blan	k) 2. REPORT DATE	3. REPORT TYPE AND DATES	COVERED	
	February 1994	Final		
4. TITLE AND SUBTITLE A STRESS FACTOR METHO MUZZLE BRAKE DESIGN	OD FOR PERFORATED		MCMS: 611.02.H611.100	
6. AUTHOR(S)	-			
Garry C. Carofano and Martin	n R. Leach		•	
7. PERFORMING ORGANIZATION NA	AME(S) AND ADDRESS(ES)		ORMING ORGANIZATION RT NUMBER	
U.S. Army ARDEC				
Benét Laboratories		Α	RCCB-TR-94007	
Watervliet, NY 12189-4050				
9. SPONSORING/MONITORING AGI	ENCY NAME(S) AND ADDRESS(ES)	10. SPOI	ISORING / MONITORING	
U.S. Army ARDEC				
Close Combat Armaments Ce			•	
Picatinny Arsenal, NJ 07806-5	000			
11. SUPPLEMENTARY NOTES				
	the 1994 ASME Pressure Vessel	and Piping Conference, 19-23 Ju	ne 1994, Minneapolis, MN.	
Accepted for publication in th			•	
12a. DISTRIBUTION / AVAILABILITY	STATEMENT	12b. DIS	TRIBUTION CODE	
Approved for public release; of	distribution unlimited			
13. ABSTRACT (Maximum 200 words)				
A perforated muzzle brake consists of a set of vents drilled through the wall of a cannon near the muzzle to reduce the impulse transmitted to the mount. The vented structure must support both the tube pressure and the pressure acting on the vent surfaces that produces the braking force. This report presents a method for estimating the maximum Von Mises stress within the structure. The results agree to within 10 percent of those from a more detailed finite element calculation.				
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14. SUBJECT TERMS Gun, Muzzle Brake, Cylinder With Multiple Holes, Stress Factors			15. NUMBER OF PAGES 15	
·			16. PRICE CODE	
17. SECURITY CLASSIFICATION OF REPORT	18. SECURITY CLASSIFICATION OF THIS PAGE	19. SECURITY CLASSIFICATION OF ABSTRACT	20. LIMITATION OF ABSTRACT	
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1. AGENCY USE ONLY (Leave bla	nk) 2. REPORT DATE March 1994	3. REPORT TYPE AND D Final	ATES COVERED	
4. TITLE AND SUBTITLE	March 1994		FUNDING NUMBERS	
EVALUATION OF THE "SO	OFT-RIDE"			
MUZZLE REFERENCE SY	STEM COLLIMATORS		AMCMS: 6126.24.H180.0	
6. AUTHOR(S)				
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7. PERFORMING ORGANIZATION N	IAME(S) AND ADDRESS(ES)	8.	PERFORMING ORGANIZATION REPORT NUMBER	
U.S. Army ARDEC			•	
Benét Laboratories, SMCAR-	CCB-TL		ARCCB-TR-94008	
Watervliet, NY 12189-4050		,		
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9. SPONSORING / MONITORING AG	SENCY NAME(S) AND ADDRESS(ES)	SPONSORING/MONITORING AGENCY REPORT NUMBER	
U.S. Army ARDEC				
Close Combat Armaments Ce				
Picatinny Arsenal, NJ 07801-5	000	j		
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11. SUPPLEMENTARY NOTES				
12a. DISTRIBUTION / AVAILABILITY	STATEMENT	12	b. DISTRIBUTION CODE	
Distribution limited to U.S. G.	overnment Agencies only becaus	of test and		
	er requests for this document mu			
	ament Research, Development, a			
Center, ATTN: Benét Laboratories, SMCAR-CCB-DA, Watervliet, NY 12189-4050.				
13. ABSTRACT (Maximum 200 words) This report presents the results of a series of tests used to evaluate two experimental "Soft-Ride" Muzzle Reference System				
			Cused on the M1A1 Abrams tank. ere for the M1A1 MRSC. Testing	
consisted of non-firing environmental tests, as well as hardstand and vehicle firing tests. The MRSCs were evaluated based upon their boresight retention accuracy and their ability to attenuate the firing load experienced by the MRSC optics. Results indicate				
that both "Soft-Ride" MRSC configurations can significantly attenuate the firing loads seen by the MRSC optics, however, only				
the banded configuration prov	rides accuracy comparable to the	M1A1 MRSC.		
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14. SUBJECT TERMS Muzzle Reference Systems, Collimators, M1A1 Abrams Tank, Boresight,			15. NUMBER OF PAGES 47	
120-mm M256 Tube, Cannon Tubes, Muzzle Boresight Device, Dynamic Strain,				
Dynamic Strain Waves			16. PRICE CODE	
	40 CECHOLTY CLASSIFICATION	40 CECUDITY CLASSIFICAT	ION 20 LIMITATION OF ARCTRACT	
17. SECURITY CLASSIFICATION OF REPORT	18. SECURITY CLASSIFICATION OF THIS PAGE	19. SECURITY CLASSIFICAT OF ABSTRACT	ION 20. LIMITATION OF ABSTRACT	
UNCLASSIFIED	UNCLASSIFIED	UNCLASSIFIED		

Form Approved
OMB No. 0704-0188

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Davis Highway, soite 1204; Hinnigton; ext 2220	- 1300,10110101010101010101010101010101010		
1. AGENCY USE ONLY (Leave blan	nk) 2. REPORT DATE	3. REPORT TYPE AND D	ATES COVERED
	March 1994	Final	
4. TITLE AND SUBTITLE DESIGN OF A FATIGUE-RESIST 3,000 KIPS OF END LOAD AS A CYCLIC TESTING OF OPEN-EN 6. AUTHOR(S)		•	FUNDING NUMBERS AMCMS No. 6126.24.H180.0 PRON No. 1A12ZWGBNMBJ
Michael J. Audino and Joseph A. I	Карр .		
7. PERFORMING ORGANIZATION N	IAME(S) AND ADDRESS(ES)	8.	PERFORMING ORGANIZATION
U.S. Army ARDEC Benet Laboratories, SMCAR-CCB- Watervliet, NY 12189-4050	TL		ARCCB-TR-94009
9. SPONSORING/MONITORING AG U.S. Army ARDEC Close Combat Armaments Center	ENCY NAME(S) AND ADDRESS(ES)	10	. SPONSORING / MONITORING AGENCY REPORT NUMBER
Picatimny Arsenal, NJ 07806-5000			
11. SUPPLEMENTARY NOTES Presented at the ASTM Pressure V Published in Proceedings of the Co	essel Conference, New Orleans, LA	, May 1992.	
12a. DISTRIBUTION / AVAILABILITY	STATEMENT	. 12	b. DISTRIBUTION CODE
Approved for public release; distri	bution unlimited.		
13. ABSTRACT (Maximum 200 wor	ds)		
open-ended cylinders requires pres	sures as high as 100 Ksi, the fatigue	e-loading conditions on the te	re. Since testing these large diameter, esting equipment are very demanding. Is through the use of an external press.
The press design discussed in this loads as high as 3000 kips. This p	report deals with the design proceduress design involves the use of two	res involved in developing a low deflection platens conne	n infinite life press that can react end ected by two high strength posts.
extension is to preload the threaded of enhancement became the metho inches by mechanical means require	i post producing a high mean stress, od of choice. Producing sufficient p	but reducing the alternating s xeload on a post with a diam sently available. By using ele	d. The most effective method of life tress or stress amplitude. This avenue neter of 7 inches and a length of 115 ectric heating elements inserted at the
14. SUBJECT TERMS			15. NUMBER OF PAGES
Safe Service Life, Soderberg Crite	ria, Stress Amplitude, Alternating P	ress	21 16. PRICE CODE
17. SECURITY CLASSIFICATION	18. SECURITY CLASSIFICATION OF THIS PAGE	19. SECURITY CLASSIFICATION OF ABSTRACT	TION 20. LIMITATION OF ABSTRACT
OF REPORT	INCLASSIFIED	UNCLASSIFIED	UL

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OMB No. 0704-0188

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1. AGENCY USE ONLY (Leave blan	k) 2. REPORT DATE	3. REPORT TYPE AND DATES COVERED			
	March 1994	Final			
. ,	TRANSLAMINAR FRACTUR ENTS FROM CARBON/EPOXY	RE A	MCMS: 6111.02.H611.1 PRON: 1A11Z1CANMBJ		
6. AUTHOR(S)					
J.H. Underwood and M.T. Ko	rtschot (University of Toronto)				
7. PERFORMING ORGANIZATION NA	AME(S) AND ADDRESS(ES)		REPORMING ORGANIZATION		
U.S. Army ARDEC Benét Laboratories, SMCAR-0 Watervliet, NY 12189-4050	CCB-TL		PORT NUMBER ARCCB-TR-94010		
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 SPONSORING/MONITORING AGE U.S. Army ARDEC Close Combat Armaments Cer Picatinny Arsenal, NJ 07801-50 	iter	10. SP	ONSORING / MONITORING SENCY REPORT NUMBER		
reading Alsena, 143 07601-30					
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11. SUPPLEMENTARY NOTES Presented at the 2nd Internation 1993. Published in the Conference	nal Conference on Deformation ence Proceedings.	and Fracture of Composites, N	Manchester, U.K., 29-31 March		
12a. DISTRIBUTION / AVAILABILITY	STATEMENT	12b. I	DISTRIBUTION CODE		
Approved for public release; d	istribution unlimited.				
13. ABSTRACT (Maximum 200 word	s)				
Notched [0/+45/90/-45] carbon/epoxy laminates were used to study translaminar fracture, where through-thickness cracking propagates across fibers and laminae. Radiographs of damage were compared with crack growth determined from load-versus-deflection plots using elastic fracture mechanics. Comparison of damage at the notch tip with fracture mechanics evaluations identified some material/test conditions for which a critical value of fracture toughness is a useful concept. For other conditions, the extent of damage in the specimen showed that the concept of fracture toughness is not directly applicable.					
14. SUBJECT TERMS Carbon/Epoxy, Laminates, Cor		- D-111	15. NUMBER OF PAGES		
Carbon/Epoxy, Laminates, Cor Fracture Mechanics, Fracture		e, Kadiography,	13 16. PRICE CODE		
17. SECURITY CLASSIFICATION OF REPORT	18. SECURITY CLASSIFICATION OF THIS PAGE	19. SECURITY CLASSIFICATION OF ABSTRACT	20. LIMITATION OF ABSTRACT		
UNCLASSIFIED	UNCLASSIFIED	UNCLASSIFIED	UL		

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OMB No. 0704-0188

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1. AGENCY USE ONLY (Leave blank)

2. REPORT DATE

3. REPORT TYPE AND DATES COVERED

1. AGENCY USE ONLY (Leave blank)	2. REPORT DATE	3. REPORT TYPE AND DATES COVERED		
·	March 1994	Final		
4. TITLE AND SUBTITLE CHROMIUM/MOLYBDENUM A THE ELECTRODEPOSITION O MOLYBDENUM ALLOYS USIN	5. FUNDING NUMBERS AMCMS: 6111.02.H611.1			
6. AUTHOR(S)				
Mark D. Miller and Stephen Lang				
7. PERFORMING ORGANIZATION NAME	(S) AND ADDRESS(ES)		8. PERFORMING ORGANIZATION	
U.S. Army ARDEC			REPORT NUMBER	
Benét Laboratories, SMCAR-CCB Watervliet, NY 12189-4050	3-TL .		ARCCB-TR-94011	
9. SPONSORING/MONITORING AGENCY	NAME(S) AND ADDRESS(ES)		10. SPONSORING / MONITORING AGENCY REPORT NUMBER	
U.S. Army ARDEC				
Close Combat Armaments Center				
Picatinny Arsenal, NJ 07801-5000				
11. SUPPLEMENTARY NOTES				
12a. DISTRIBUTION / AVAILABILITY STAT	rement		12b. DISTRIBUTION CODE	
Approved for public release; distri	bution unlimited			
13. ABSTRACT (Maximum 200 words)				
The microstructure and mechanica deposit were evaluated and comparconcentrations as high as approximatime). This represents nearly a 30 deposit. However, pulse-plated LC and nodular in appearance. Hardralloy deposits. This hardness represents and mechanical services and mechanical services and mechanical services.	red to both pulse-plated LC chately 2.4 percent were obtaine 0 percent increase over the percent of the percent increase over the percent of the percent as a percent increase of the percent increase of the percent of the percent increase of the percent of the p	romium and direct (d d at a pulsing frequen reent molybdenum of ly poor in quality with I (50 gm load) were of ver the maximum rep (CCE) obtained whil	chromium/molybdenum (Cr/Mo) alloy c)-plated LC chromium. Molybdenum cy of 5 Hz (100 ms on-time/100 ms off-tained in a dc-plated LC Cr/Mo alloy deposits that were frequently cracked btained for the pulse-plated LC Cr/Mo orted hardness obtained in a dc-plated e pulse plating an LC Cr/Mo alloy was plating LC chromium.	

14. SUBJECT TERMS Chromium/Molybdenum Allo	15. NUMBER OF PAGES 13		
		•	16. PRICE CODE
17. SECURITY CLASSIFICATION OF REPORT	18. SECURITY CLASSIFICATION OF THIS PAGE	19. SECURITY CLASSIFICATION OF ABSTRACT	20. LIMITATION OF ABSTRACT
UNCLASSIFIED	UNCLASSIFIED	UNCLASSIFIED	UL 200

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1. AGENCY USE ONLY (Leave blan	nk) 2. REPORT DATE March 1994	3. REPORT TYPE AND DATES COVERED Final		
4. TITLE AND SUBTITLE CALCULATIONS VIA SUCCESSIVE APPROXIMATIONS OF STRESS AND STRAIN DISTRIBUTION IN THICK-WALLED CONCENTRIC 5. FUND AMOUNT			DING NUMBERS ACMS: 612624H180.000 ACN: M721F221M71A	
6. AUTHOR(S)				
Boaz Avitzur				
7. PERFORMING ORGANIZATION N U.S. Army ARDEC	AME(S) AND ADDRESS(ES)		ORMING ORGANIZATION ORT NUMBER	
Benét Laboratories, SMCAR- Watervliet, NY 12189-4050	CCB-TL		ARCCB-TR-94012	
9. SPONSORING/MONITORING AG	ENCY NAME(S) AND ADDRESS(ES)	10. SPC	NSORING/MONITORING NCY REPORT NUMBER	
U.S. Army ARDEC Close Combat Armaments Ce Picatinny Arsenal, NJ 07806-5		AGI		
11. SUPPLEMENTARY NOTES		•		
12a. DISTRIBUTION / AVAILABILITY	STATEMENT	12b. Di	STRIBUTION CODE	
Approved for public release; d				
thermal expansion of hotter seexpansion of the inner layer.) of successive approximations hetween the stress and strain is orthogonal coordinate direction with. Temperature dependent computed to detect potential yes surfaces and the axial ends of	ubjected to radial temperature gra egments. (For example, in an in Constraint of the thermal expansion has been used to calculate such standard such standard such as described by the constitutions, and compatibility (or conservations, and compatibility (or conservations). The total strain (thermal at the tube) represents the dilation	ternally heated tube, outer portion results in triaxial stress and stress and stress and strain fields, while accutive equations. Equilibrium is it ion and continuity of matter) required the material is accounted for. In the boundary of t	tions of the tube contain the ain distributions. A sequence counting for the mutual effect satisfied in all three mutually uirements are being complied. The Mises' numbers field is	
14_SUBJECT JERMS Thick-Walled Tubes, Thermal	Dilation, Temperature Gradient		15. NUMBER OF PAGES 18 16. PRICE CODE	
17. SECURITY CLASSIFICATION OF REPORT	18. SECURITY CLASSIFICATION OF THIS PAGE	19. SECURITY CLASSIFICATION OF ABSTRACT	20. LIMITATION OF ABSTRACT	
UNCLASSIFIED	UNCLASSIFIED	UNCLASSIFIED	UL	

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OMB No. 0704-0188

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Davis Highway, Suite 1204, Annuguen, The 2220			
1. AGENCY USE ONLY (Leave blan		3. REPORT TYPE AND DATES	COVERED
	March 1994	Final	
4. TITLE AND SUBTITLE QUALIFICATION OF M256 BREECHBLOCK WELD REPAIR 5.			ING NUMBERS CMS No. 6126.24.H180.0 IN No. 1A12ZTP9NMSC
6. AUTHOR(S)			
David A. Porter, William E. Marco	ux, and Alice E. Fish		
7. PERFORMING ORGANIZATION N	AME(S) AND ADDRESS(ES)		ORMING ORGANIZATION
U.S. Army ARDEC Benet Laboratories, SMCAR-CCB- Watervliet, NY 12189-4050	TL	1	RT NUMBER CCB-TR-94013
9. SPONSORING/MONITORING AG	ENCY NAME(S) AND ADDRESS(ES	10. SPON	ISORING / MONITORING
U.S. Army ARDEC Close Combat Armaments Center Picatimny Arsenal, NJ 07806-5000	•	AGE	NCY REPORT NUMBER
11. SUPPLEMENTARY NOTES			
12a. DISTRIBUTION / AVAILABILITY	STATEMENT	12b. DIS	TRIBUTION CODE
Approved for public release; distrib	urtian realizated		•
Approved for phone release, distric	duon unimined.		
13. ABSTRACT (Maximum 200 word	ds)		
A more engineered approach was ta the principal areas requiring weld accumulating a shock and vibration	repair, (2) identifying a weld proc	edure and material, (3) preparing v	
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14. SUBJECT TERMS			15. NUMBER OF PAGES
M256, Breechblock, Welding, Repa	air	•	20
•			16. PRICE CODE
17. SECURITY CLASSIFICATION	18. SECURITY CLASSIFICATION	19. SECURITY CLASSIFICATION	20. LIMITATION OF ABSTRACT
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1. AGENCY USE ONLY (Leave blank,	2. REPORT DATE	3. REPORT TYPE AND DATES COVERED		
	April 1994	Final		
4. TITLE AND SUBTITLE STANDARDS FOR ORDNANCE MATERIALS; DYNAMIC FRACTURE AND ENVIRONMENTAL CRACKING APPLICATIONS			DING NUMBERS ICMS No. 6111.02.H611.1 ON No. 1A11Z1CANMBJ	
6. AUTHOR(S)	•			
John H. Underwood				
7. PERFORMING ORGANIZATION NA U.S. Army, ARDEC	ME(S) AND ADDRESS(ES)		ORMING ORGANIZATION ORT NUMBER	
Benet Laboratories, SMCAR-CCB-T Watervliet, NY 12189-4050	L	AF	CCB-TR-94014	
9. SPONSORING/MONITORING AGE	NCY NAME(S) AND ADDRESS(ES)	10. SPO	NSORING/MONITORING NCY REPORT NUMBER	
U.S. Army ARDEC Close Combat Armaments Center Picatinny Arsenal, NJ 07806-5000				
11. SUPPLEMENTARY NOTES Submitted to ASTM Standardization	News	_		
		[425 0	STRIBUTION CODE	
12a. DISTRIBUTION / AVAILABILITY S Approved for public release; distribu		120. D	21KIBOTION CODE	
Approved for public release; distribu	nion unminea.			
13. ABSTRACT (Maximum 200 words)			
Two difficult and very different serv surprisingly similar approaches for f	rice conditions for Army ordnance, racture testing standards.	dynamic fracture and environme	ntally-assisted cracking, result in	
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14. SUBJECT TERMS			15. NUMBER OF PAGES	
Ordnance Materials, Dynamic Fracti Environmental Cracking, Fracture M	ure, Crack Arrest fechanics		10 16. PRICE CODE	
	8. SECURITY CLASSIFICATION OF THIS PAGE	19. SECURITY CLASSIFICATION OF ABSTRACT	20. LIMITATION OF ABSTRACT	
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Standard Form 298 Rev 2-89) Prescribed by ANSI Std 1,33-18 298-102

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Davis Highway, Suite 1204, Arlington, VA 2220			NO DATE COVERED	
1. AGENCY USE ONLY (Leave blan	nk) 2. REPORT DATE	3. REPORT TYPE A	ND DATES COVERED	
	April 1994	Final	Le supplie AU: Marre	
4. TITLE AND SUBTITLE MATERIALS ANALYSIS OF 155 ARMAMENT SYSTEM (ICAS) C. 6. AUTHOR(S)	5. FUNDING NUMBERS AMCMS No. 6126.24.H180.0			
o. 2011.01(5)				- 1
Kathryn E. Noll			,	
7. PERFORMING ORGANIZATION N	AME(S) AND ADDRESS(ES)		8. PERFORMING ORGANIZATION REPORT NUMBER	
U.S. Army ARDEC Benet Laboratories, SMCAR-CCB- Watervliet, NY 12189-4050	TL		ARCCB-TR-94015	
9. SPONSORING/MONITORING AG	ENCY NAME(S) AND ADDRES	S(ES)	10. SPONSORING / MONITORING	
U.S. Army ARDEC Close Combat Armaments Center Picatimny Arsenal, NJ 07806-5000	AGENCY REPORT NUMBER			
11. SUPPLEMENTARY NOTES				
12a. DISTRIBUTION / AVAILABILITY	STATEMENT		12b. DISTRIBUTION CODE	
Distribution limited to Department dissemination; April 1994. Other to Commander, U.S. Army Arman ATTN: Benet Laboratories, SMCA	requests for this document must tent Research, Development, as	st be referred nd Engineering Center,		
13. ABSTRACT (Maximum 200 wor	ds)			
XP-1. The cannon experienced a m examination, chemical composition	alfunction during test firing at A determination, metallographic ribute to the malfunction. An	Aberdeen Proving Ground (Mexamination, and mechanical adiabatic shear zone was obs	nament System (ICAS) Cannon, Serial I D), Range 18. The analysis included vis property determination. It was determine erved indicating the tube was subjected the tube material.	ned
14. SUBJECT TERMS			15. NUMBER OF PAGES	
Gun Tube, Adiabatic Shear Zone,	Failure Analysis		16. PRICE CODE	
17. SECURITY CLASSIFICATION OF REPORT	18. SECURITY CLASSIFICATI OF THIS PAGE	OF ABSTRACT	l l	RACT
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1. AGENCY USE ONLY (Leave blank	2. REPORT DATE	3. REPORT TYPE AND DATES COVERED			
. Activities	April 1994	Final			
4. TITLE AND SUBTITLE 155-MM ADVANCED FIELD ARTILLERY SYSTEM LIQUID PROPELLANT PROTOTYPE CANNON: PERFORMANCE OF THE WEAPON'S RECOIL SYSTEM			5. FUNDING NUMBERS AMCMS: 612624H1800 PRON: 470TEV64471A		
6. AUTHOR(S)					
Ronald G. Gast			·		
7. PERFORMING ORGANIZATION NAME(S) AND ADDRESS(ES) U.S. Army ARDEC Benét Laboratories, SMCAR-CCB-TL Watervliet, NY 12189-4050			8. PERFORMING ORGANIZATION REPORT NUMBER ARCCB-TR-94016		
9. SPONSORING/MONITORING AGE U.S. Army ARDEC			10. SPONSORING/MONITORING AGENCY REPORT NUMBER		
Close Combat Armaments Cer Picatinny Arsenal, NJ 07806-50					
11. SUPPLEMENTARY NOTES					
12a. DISTRIBUTION / AVAILABILITY	CTATEMENT		12b. DISTRIBUTION CODE		
evaluation; April 1994. Other Commander, U.S. Army Arma	Distribution limited to U.S. Government Agencies only because of test and evaluation; April 1994. Other requests for this document must be referred to Commander, U.S. Army Armament Research, Development, and Engineering Center, ATTN: Benét Laboratories, SMCAR-CCB-DC, Watervliet, NY 12189-4050.				
was tested at the Wright-Malts	f the Advanced Field Artillery Sys	'uma Proving Ground (l a tank-style mount and recoil system, Yuma, AZ) in late 1992. This report atories' recoil system modelling code.		
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14. SUBJECT TERMS Advanced Field Artillery System, Recoil Brake Analysis, Recoil Brake Performance, Liquid Propellant Artillery Gun, Data Reduction, Shock Absorbers			15. NUMBER OF PAGES 24 16. PRICE CODE		
17. SECURITY CLASSIFICATION OF REPORT	18. SECURITY CLASSIFICATION OF THIS PAGE	19. SECURITY CLASSIF OF ABSTRACT	CATION 20. LIMITATION OF ABSTRACT		
UNCLASSIFIED	UNCLASSIFIED	UNCLASSIFIED	UL		

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YIELD-BEFORE-BREAK FRACTURE MECHANICS ANALYSIS AMCMS: 611102H61111 OF HIGH STRENGTH STEEL PRESSURE VESSELS 6. AUTHOR(S) John H. Underwood, Richard A. Farrara, and Michael J. Audino 8. PERFORMING ORGANIZATION 7. PERFORMING ORGANIZATION NAME(S) AND ADDRESS(ES) REPORT NUMBER U.S. Army ARDEC ARCCB-TR-94017 Benét Laboratories, SMCAR-CCB-TL Watervliet, NY 12189-4050 10. SPONSORING / MONITORING 9. SPONSORING / MONITORING AGENCY NAME(S) AND ADDRESS(ES) AGENCY REPORT NUMBER U.S. Army ARDEC Close Combat Armaments Center Picatinny Arsenal, NJ 07806-5000 11. SUPPLEMENTARY NOTES Presented at the ASME Pressure Vessels and Piping Conference, Denver, Colorado, 26-29 July 1993. Published in the Conference Proceedings. 12b. DISTRIBUTION CODE 12a. DISTRIBUTION / AVAILABILITY STATEMENT Approved for public release; distribution unlimited 13. ABSTRACT (Maximum 200 words) Case study examples of fracture mechanics testing and analysis of Ni-Cr-Mo high strength steel cannon tubes are presented. The testing and analysis include significant plastic deformation accompanying fracture, which often occurs when high pressure is applied to high toughness steel pressure vessels. The analysis is based on a comparison of the size of the Irwin crack-tip plastic zone with the remaining ligament of the tube in the critical fatigue crack area that causes final failure. The results of the study show that the type of final failure can be predicted as either a relatively safe yield-before-break failure or a less safe running-crack type of failure for a variety of material, configuration, and loading conditions. 15. NUMBER OF PAGES 14 SUBJECT JERMS Pressure Vessels, Fracture Mechanics, High Strength Steel, Plastic Yielding, Fatigue Failure 16. PRICE CODE 20. LIMITATION OF ABSTRACT SECURITY CLASSIFICATION SECURITY CLASSIFICATION SECURITY CLASSIFICATION OF ABSTRACT OF REPORT OF THIS PAGE

UNCLASSIFIED

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1. AGENCY USE ONLY (Leave bla		3. REPORT TYPE AND	DATES COVERED
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EXPERIMENTAL HEAT TREATMENT OF BERYLLIUM COPPER ALLOY AM			AMCMS No. 6126.24.H180.0 PRON No. 1A12ZRLQNMSC
6. AUTHOR(S)			
Kathryn E. Noll			
7. PERFORMING ORGANIZATION	NAME(S) AND ADDRESS(ES)		B. PERFORMING ORGANIZATION
U.S. Army ARDEC Benet Laboratories, SMCAR-CCB Watervliet, NY 12189-4050			REPORT NUMBER ARCCB-TR-94018
9. SPONSORING/MONITORING A	GENCY NAME(S) AND ADDRESS(ES)	10. SPONSORING / MONITORING
U.S. Army ARDEC			AGENCY REPORT NUMBER
Close Combat Armaments Center Picatimy Arsenal, NJ 07806-5000			
11. SUPPLEMENTARY NOTES			
12a. DISTRIBUTION/AVAILABILITY	STATEMENT		12b. DISTRIBUTION CODE
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treatments were performed in order hardening (overaging) and (2) a scachieved in both heat-treating exp hours would obtain the desired UT	er to develop a procedure that would olution treatment and age-hardening eriments conducted. For the age-ha 'S. For the solution treatment and a	I alleviate this condition. The minimum desired ultreduning experiment, any aging the condition of the condition.	machining. Several experimental heat these treatments consisted of (1) an age-timate tensile strength (UTS) value was ing time between one-half hour and two ing for one-half hour or greater at 500°F was a one hour age-hardening at 900°F.
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14. SUBJECT TERMS			15. NUMBER OF PAGES
Beryllium Copper, Heat Treatmen	at, Age-Hardening, Overaging		14 16. PRICE CODE
17. SECURITY CLASSIFICATION	18. SECURITY CLASSIFICATION	19. SECURITY CLASSIFIC	ATION 20. LIMITATION OF ABSTRACT
OF REPORT UNCLASSIFIED	OF THIS PAGE UNCLASSIFIED	OF ABSTRACT UNCLASSIFIED	UL

Form Approved
OMB No. 0704-0188

Public reporting burden for this collection of information is estimated to average 1 hour per response, including the time for reviewing instructions, leartning existing data Sources, gathering and maintaining the data needed, and completing and reviewing the collection of information. Send comments regarding this burden estimate or air. There aspect of this collection of information, including suggestions for reducing this burden, to Washington Headquarters Services, Directorate for information Diserations and Reports, 1215 Lefferson Davis Highway, Suite 1204, Arlington, VA. 22202-4302, and to the Office of Management and Budget, Paperwork Reduction Project (0704-0195). Washington, DC 20503

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	May 1994	Final		
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6. AUTHOR(S)				
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7. PERFORMING ORGANIZATION N	AME(S) AND ADDRESS(ES)			MING ORGANIZATION
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9. SPONSORING/MONITORING AG	ENCY NAME(S) AND ADDRESS(F	5)	10. SPONSO	RING / MONITORING
U.S. Army ARDEC Close Combat Armaments Ce Picatinny Arsenal, NJ 07806-5	nter	5,		REPORT NUMBER
11. SUPPLEMENTARY NOTES				
Submitted to: Journal of Comp	nutational Physics			
12a. DISTRIBUTION / AVAILABILITY	STATEMENT		12b. DISTR	BUTION CODE
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13. ABSTRACT (Maximum 200 word	ds)			
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14_SUBJECT TERMS Fractals, Multifractal Measure	s. Box-Counting Algorithms. Co	orrelation Integral Me	thods.	5. NUMBER OF PAGES 38
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Form Approved
OMB No. 0704-0188

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1. AGENCY USE ONLY (Leave bi	ank) 2. REPORT DATE	3. REPORT TYPE A	3. REPORT TYPE AND DATES COVERED		
	May 1994	Final			
4. TITLE AND SUBTITLE AUTOMATED WELDING OF ROTARY FORGE HAMMERS 5.			5. FUNDING NUMBERS Operations Order No. 8430		
6. AUTHOR(S)			- · · · · · · · · · · · · · · · · · · ·		
John R. Senick, Jr.					
7. PERFORMING ORGANIZATION	NAME(S) AND ADDRESS(ES)		8. PERFORMING ORGANIZATION REPORT NUMBER		
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9. SPONSORING/MONITORING A	GENCY NAME(S) AND ADDRES	SS(ES)	10. SPONSORING / MONITORING		
U.S. Army ARDEC			AGENCY REPORT NUMBER		
Close Combat Armaments Center Picatinny Arsenal, NJ 07806-5000	•				
11. SUPPLEMENTARY NOTES					
12a. DISTRIBUTION / AVAILABILITY	Y STATEMENT		12b. DISTRIBUTION CODE		
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Benet Laboratories under a Man	ufacturing Methods and Techno d flux-cored wire-feed welding	ology project at Watervliet	ng rotary forge hammers was performed by Arsenal. Two welding technologies were process and powdered metal feed welding		
hammer repair. Both contracts in	volved welding representative to parameters to weld-overlay actu	est samples to determine the o	of and welding parameters necessary for ptimum parameters for deposition rate and hammers were then returned to Watervliet		
Based on encouraging results general is the current production welcomes			ethod has been implemented at the Arsenal		
14. SUBJECT TERMS			15. NUMBER OF PAGES		
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Form Approved OMB No. 0704-0188

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4. TITLE AND SUBTITLE SERVO CONTROL USING		!			5. FUND	ING NUMBERS
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6. AUTHOR(S)						
Ronald L. Racicot						
7. PERFORMING ORGANIZATION N	NAME	(S) AND ADDRESS(ES)				RMING ORGANIZATION
U.S. Army ARDEC						RT NUMBER
Benét Laboratories, SMCAR- Watervliet, NY 12189-4050	-CCB	-1L			Ar	RCCB-TR-94021
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Close Combat Armaments Ce	enter					
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Published in: IEEE Transactio	ns on	Control Systems Technology	,			
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12a. DISTRIBUTION / AVAILABILITY	STAT	rement			12b. DIS	TRIBUTION CODE
Approved for public release; of	distrit	oution unlimited				
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This report describes an appro- mechanism using switches. The						
continuous feedback sensors for						
during motion is provided to th	he cor	ntroller. Based on this time-p	osition	information, cons	t ant moto	r forces to be applied between
switches are determined to sust						
here, but rather a promising or						
intended to compete with more computer power. On the cont						
less expensive components.						
probability and statistical conce	epts ii	n determining the switch loca	tions a	nd the required re	al time m	otor forces. A probabilistic
approach is needed because of						
switches. These uncertainties given motion cycle. In this rep						
verify the results using simulat						
mechanism of a large caliber	tank	autoloader with excellent re	sults. 1	From our experim	ental wor	
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1. AGENCY USE ONLY (Leave bla	enk) 2. REPORT DATE	3. REPORT TYPE AND DATE	S COVERED		
	May 1994	Final			
4. TITLE AND SUBTITLE METALLURGICAL EVALUATI GUN TUBES, SERIAL NOS. 123	TER A	NDING NUMBERS MCMS No. 6126.24.H180.0 RON No. F11XB066M1A1			
6. AUTHOR(S)					
Kathryn E. Noll and John R. Seni	ck, Jr.				
7. PERFORMING ORGANIZATION	NAME(S) AND ADDRESS(ES)		FORMING ORGANIZATION		
U.S. Army ARDEC Benet Laboratories, SMCAR-CCB Watervliet, NY 12189-4050	:- TL		ORT NUMBER RCCB-TR-94022		
9. SPONSORING/MONITORING AC	GENCY NAME(S) AND ADDRESS(E	5) 10. SP	ONSORING / MONITORING		
U.S. Army ARDEC Close Combat Armaments Center Picatinny Arsenal, NJ 07806-5000)	AG	ENCY REPORT NUMBER		
11. SUPPLEMENTARY NOTES					
12a. DISTRIBUTION / AVAILABILITY	STATEMENT	112h C	ISTRIBUTION CODE		
Distribution limited to Department because of premature dissemination referred to Commander, U.S. Arm Center, ATTN: Benet Laboratorie	fense contractors nis document must be nt, and Engineering				
13. ABSTRACT (Maximum 200 words)					
included visual examination, mech- composition determination. Based to have been processed correctly.	25-mm M242 Bushmaster gun tub anical property determination, scann on the hardness values, chemical co An area toward the muzzle end to overheating during firing. Uran	ing electron microscopy, metallogi mposition, and microstructure obse of Serial No. 12373 displayed a	aphic examination, and chemical rved, the two gun tubes appeared lower hardness and an altered		
14. SUBJECT TERMS			15. NUMBER OF PAGES		
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4. TITLE AND SUBTITLE THE EFFECTS OF FATIGUE LI LIFE OF HIGH-STRENGTH PR 6. AUTHOR(S) Robert R. Fujczak			GUE	AM	OING NUMBERS CMS No. 6111.02.H611.1 N No. 1A11Z1CANMBJ
7. PERFORMING ORGANIZATION U.S. Army ARDEC Benet Laboratories, SMCAR-CCI Watervliet, NY 12189-4050		S) AND ADDRESS(ES)		REPO	DRMING ORGANIZATION RT NUMBER CCB-TR-94023
9. SPONSORING/MONITORING A	GENCY	NAME(S) AND ADDRESS(ES)		SORING / MONITORING
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11. SUPPLEMENTARY NOTES		· · · · · · · · · · · · · · · · · · ·			
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Bend specimens of high-strength frequencies. In the 1.5 to 15 Hz 175 Hz range, there was a definite over the stress range was a factor decreased at higher stresses, but frequency effect is more effective by superimposition of loads under	range, to increase of 10 even at at high-	here was no discernible differ e in fatigue life compared to greater than the life at the le the highest stresses tested, to cycle fatigue and diminishes	rence in the frequency effect the lower range of frequency ower frequency range. The the increase was significated with low-cycle fatigue. A	ect on fatig ncy. The his factor int. about 5	the life. However, in the 30 to average increase in fatigue life increased at lower stresses and to 1. This indicates that the
14. SUBJECT TERMS					15. NUMBER OF PAGES
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OMB No. 0704-0188 Public reporting burden for this collection of information is estimated to average 1 hour per response, including the time for reviewing instructions, searching existing data sources, gathering and maintaining the data needed, and completing and reviewing the collection of information. Send comments regarding this burden estimate or any other aspect of this collection of information, including suggestions for reducing this burden, to Washington Headquarters Services. Directorate for information Operations and Reports, 1215 Jefferson Davis Highway, Suite 1204, Arlington, VA 22202-4302, and to the Office of Management and Budget, Paperwork Reduction Project (0704-0188), Washington, DC 20503. 3. REPORT TYPE AND DATES COVERED 2. REPORT DATE 1. AGENCY USE ONLY (Leave blank) June 1994 5. FUNDING NUMBERS 4. TITLE AND SUBTITLE FATIGUE LIFE TESTS FOR THE MUZZLE REFERENCE AMCMS: 612624H180 SYSTEM COLLIMATOR ON THE 120-MM M256 PRON: 472GEV16471A **CANNON TUBE** 6. AUTHOR(S) J.H. Underwood, E. Troiano, D.E. Leighton, R.T. Abbott, D. Crayon, V.J. Olmstead, and R.A. Farrara PERFORMING ORGANIZATION 7. PERFORMING ORGANIZATION NAME(S) AND ADDRESS(ES) REPORT NUMBER U.S. Army ARDEC ARCCB-TR-94024 Benét Laboratories, SMCAR-CCB-TL Watervliet, NY 12189-4050 10. SPONSORING / MONITORING 9. SPONSORING/MONITORING AGENCY NAME(S) AND ADDRESS(ES) AGENCY REPORT NUMBER U.S. Army ARDEC Close Combat Armaments Center Picatinny Arsenal, NJ 07806-5000 11. SUPPLEMENTARY NOTES 12b. DISTRIBUTION CODE 12a. DISTRIBUTION / AVAILABILITY STATEMENT Distribution limited to U.S. Government agencies only because of contractor performance evaluator; June 1994. Other requests for this document must be referred to Commander, U.S. Army Armament Research, Development, and Engineering Center, ATTN: Benét Laboratories, SMCAR-CCB-RM, Watervliet, NY 12189-4050. 13. ABSTRACT (Maximum 200 words) A laboratory fatigue life test system was developed to obtain comparative life data for the muzzle reference system collimator on the 120-mm M256 cannon tube. A fatigue load was established which, although only indirectly shown to correspond to the service loading, is believed to provide valuable comparative life data for different means of fastening key components of the collimator. Fatigue lives were measured for various means of fastening, including different configurations of electron-beam welding and different sizes and types of high strength screws. Using the S-N fatigue life approach, consistent descriptions of the fatigue life of the muzzle reference system collimator could be made. 15. NUMBER OF PAGES 14 SUBJECT TERMS
Fatigue Life, Electron-Beam Weld, Fasteners, Cannon Tube, S-N Curve, Muzzle Reference System 16. PRICE CODE 20. LIMITATION OF ABSTRACT SECURITY CLASSIFICATION OF THIS PAGE SECURITY CLASSIFICATION 17. SECURITY CLASSIFICATION

OF REPORT

Standard Form 298 (Rev. 2-89)

Prescribed by ANSI Std Z39-18 298-102

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Form Approved
OMB No. 0704-0188

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6. AUTHOR(S)					
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7. PERFORMING ORGANIZATION NA	ME(S) AND ADDE	RESS(ES)		8. PERFO	RMING ORGANIZATION
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6. AUTHOR(S)			
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technology and specific authority;	July 1994. Other requests for this		
document must be referred to Com	nmander, U.S. Army Armament Res	search,	
Development, and Engineering Cer			
SMCAR-CCB-TL, Watervliet, NY			
13. ABSTRACT (Maximum 200 wor	ds)		
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AUTOMATED DATA BASE OF PHYSICAL PROPERTIES FOR O		AM	CMS No. 6111.02.H611.1 DN No. 1A11Z1CANMBJ		
6. AUTHOR(S)					
Robert R. Fujczak, Gerald L. Sper John H. Underwood, and Edward					
7. PERFORMING ORGANIZATION	MAME(S) AND ADDRESS(ES)	g DEREC	DRMING ORGANIZATION		
U.S. Army ARDEC Benet Laboratories, SMCAR-CCB		REPO	RT NUMBER CCB-TR-94027		
Watervliet, NY 12189-4050					
9. SPONSORING/MONITORING AC	SENCY NAME(S) AND ADDRESS(ES		ISORING / MONITORING		
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11. SUPPLEMENTARY NOTES					
12a. DISTRIBUTION / AVAILABILITY	STATEMENT	12b. Dis	TRIBUTION CODE		
because of critical technology; July referred to Commander, U.S. Arm	of Defense and Department of Def y 1994. Other requests for this doc y Armament Research, Developments, SMCAR-CCB-RM, Watervliet, N	ument must be at, and Engineering			
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17. SECURITY CLASSIFICATION	18. SECURITY CLASSIFICATION	19. SECURITY CLASSIFICATION	20. LIMITATION OF ABSTRACT		
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Form Approved
OMB No. 0704-0188

Public reporting burden for this collection of information is estimated to average 1 hour per response, including the time for reviewing instructions sear, in highesting data sources, gathering and maintaining the data needed, and completing and reviewing the collection of information. Send comments regarding this burden lest material specified in this burden, to Washington Headquarters Services, Directorate for information Operations and Reports, 1215 Jefferson Davis Highway, Suite 1204, Arlington, VA 22202-4302, and to the Office of Management and Burden. Place recovery Reduction Project (2024-0138), Washington and Total Office of Management and Burden.

	02-4302, and to the Office of Management and		•
1. AGENCY USE ONLY (Leave bla	enk) 2. REPORT DATE	3. REPORT TYPE AND DAT	TES COVERED
	August 1994	Final	
4. TITLE AND SUBTITLE PERIMETER-YARDSTICK FRACTURE SURFACE FR 6. AUTHOR(S)	AMCMS: 6111.02.H611.1 PRON: 1A1321CANMBJ		
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7. PERFORMING ORGANIZATION	NAME(S) AND ADDRESS(ES)		ERFORMING ORGANIZATION EPORT NUMBER
U.S. Army ARDEC Benét Laboratories, SMCAR Watervliet, NY 12189-4050		ARCCB-TR-94028	
9. SPONSORING / MONITORING AC	SENCY NAME(S) AND ADDRESS(E		PONSORING MONITORING
U.S. Army ARDEC Close Combat Armaments Co Picatinny Arsenal, NJ 07806-5		GENCY REPORT NUMBER	
11. SUPPLEMENTARY NOTES		1	
12a. DISTRIBUTION / AVAILABILITY	CTATEMENT	T 12h	DISTRIBUTION CODE
128. DISTRIBUTION / AVAILABILITY	SIATEMENT	120.	DISTRIBUTION CODE
Approved for public release;			
13. ABSTRACT (Maximum 200 word	de)	<u> </u>	
Local fractal dimensions $\alpha(x, x)$ sectioning of fracture surfaces alloy, have been determined to fracture surface section is measurface analysis, yielded $\alpha(x, x)$ and lakes in ASTM A723 stedimension of 1.25 obtained by alloys previously studied. The analogous to differences in the	ϵ), which are closely related to a produced in Charpy impact test by perimeter-yardstick analysis. I assured at several different magniful sland or lake. Perimeter-yardstic-values ranging from 1.17 to 1.40 (tell for ϵ -values near 1.3 10^4 cm. by slit-island analysis of the same island-to-island and lake-to-lake a fractal dimensions of the coastle range of $\alpha(x_{\epsilon})$ -values determine	ing of a high-strength and high in this type of analysis, the perifications, and Richardson's equivalent analysis, which had not prevenean: 1.28, standard deviation: The mean $\alpha(\mathbf{x}, \epsilon)$ -value is confracture surface sections—a valuariations of the local fractal dines of Norway and England.	toughness steel (ASTM A723) meter of an island or lake on a ation is employed to determine riously been applied to fracture 0.08) for Charpy fracture islands sistent with the (global) fractal are typical of high-strength steel imensions reflect real variations Either the fracture surfaces are
14_SUBJECT JERMS Fractals, Fracture, Crowding I	Indiana Slit Taland Mathad	·	15. NUMBER OF PAGES
Tractals, Tracture, Crowding 1	ndices, Sit-Island Method		9 16. PRICE CODE
17. SECURITY CLASSIFICATION OF REPORT	18. SECURITY CLASSIFICATION OF THIS PAGE	19. SECURITY CLASSIFICATION	N 20. LIMITATION OF ABSTRACT
UNCLASSIFIED	UNCLASSIFIED	UNCLASSIFIED	UNCI ASSIFIED

Form Approved
OMB No. 0704-0188

Public reporting burden for this collection of information is estimated to average 1 hour per response, including the time for reviewing instructions, searching existing data sources, gathering and maintaining the data needed, and completing and reviewing the collection of information. Send comments regarding this burden estimate or any other aspect of this collection of information, including suggestions for reducing this burden, to Washington Headquarters Services, Directorate for information Operations and Reports, 1215 Jefferson Davis Highway, Suite 1204, Arlington, VA. 22202-4302, and to the Office of Management and Budget. Paperwork Reduction Project (0704-0199), Washington, DC 20503

1. AGENCY USE ONLY (Leave bla	ank)	2. REPORT DATE	3. REPORT TYPE AND DATES COVERED			
		August 1994	Final			
4. TITLE AND SUBTITLE EXPONENTS IN LIFETIME AND POWER SPECTRAL DENSITY IN SELF-ORGANIZED CRITICAL SYSTEMS			АМ	ING NUMBERS CMS: 6111.02.H611.1 ON: 1A13Z1CANMBJ		
6. AUTHOR(S)				1		
L.V. Meisel and P.J. Cote						
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7. PERFORMING ORGANIZATION U.S. Army ARDEC	NAME(S) AND ADDRESS(ES)			PRMING ORGANIZATION RT NUMBER	
Benét Laboratories, SMCAR	-CCB	TL		AR	CCB-TR-94029	
Watervliet, NY 12189-4050						
9. SPONSORING/MONITORING A	GENCY	NAME(S) AND ADDRESS(ES)		SORING / MONITORING ICY REPORT NUMBER	
U.S. Army ARDEC Close Combat Armaments Co				AGLI	CI REPORT MONDER	
Picatinny Arsenal, NJ 07806-		•				
11. SUPPLEMENTARY NOTES Submitted to: Computers in P.	· Lancian					
Submitted to. Computers in F.	nysics					
12a. DISTRIBUTION / AVAILABILITY	STAT	EMENT		12b. DIS	TRIBUTION CODE	
Approved for public release;	dianih	ution valimited				
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Bak, Tang, and Weisenfeld (BTW) established that power-law frequency dependencies in the power spectral density (PSD) and size-effect modified power-law distributions of lifetimes are the fingerprints of self-organized critical systems. Jensen, Christensen, and Fogedby (JCF) clarified the ideas introduced by BTW and established the connection between the distribution of lifetimes and the PSD for the case of exponentially cutoff ("size-effect" modified) distributions of lifetimes. Here the (JCF) connection between the PSD and the distribution of lifetimes is established for sharp cutoff distributions, which supports the idea that the JCF connection holds for quite general "size-effect" modified lifetime distributions. The PSD may be expressed in terms of generalized hypergeometric functions in this case. A detailed discussion of the JCF connections is presented for a subset of values of the lifetime distribution exponent for which the generalized hypergeometric functions reduce to Fresnel integrals and sine and cosine integrals, which were the subject of a recent "Numerical Recipes" column. All calculations were performed in Mathematica.						
14 SUBJECT TERMS Self-Organized Phenomena, I	Ivpert	polic Distributions. Power I	aws. Fresnel Integrals		15. NUMBER OF PAGES	
Sine Integrals, Mathematica	-3E		, r remer micegrams,		16. PRICE CODE	
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17. SECURITY CLASSIFICATION OF REPORT		SECURITY CLASSIFICATION OF THIS PAGE	19. SECURITY CLASSIFIC OF ABSTRACT	CATION	20. LIMITATION OF ABSTRACT	
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OMB No. 0704-0188

Public reporting burden for this collection of information is estimated to average 1 hour per response, including the time for reviewing instructions, searchingles sting data sources, gathering and maintaining the data needed, and completing and reviewing the collection of information. Send comments regarding this burden estimate or any other aspect of this collection of information, including suggestions for reducing this burden, to Washington Headquarter's Services, Directorate for information Operations and Pepons, 1215 Jefferson Davis Holyays, Suite 1204, Artification, VA, 22202-4302, and to the Office of Management and Budget, Papermovic Reduction Project (0764-0188), Washington, 1923-03503.

Davis Highway, Suite 1204, Arlington, VA 22202					
1. AGENCY USE ONLY (Leave, blan	k) 2. REPORT DATE	3. REPORT TYPE AND I	DATES COVERED		
	August 1994	Final			
4. TITLE AND SUBTITLE		5.	FUNDING NUMBERS		
FAILURE ANALYSIS OF 120-MM		AMCMS No. 6126.24.H180.0			
BUSHINGS AND FIRING PINS			PRON No. W161F125M71A		
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6. AUTHOR(S)		1			
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7. PERFORMING ORGANIZATION NA	AME(S) AND ADDRESS(ES)	8.	PERFORMING ORGANIZATION REPORT NUMBER		
U.S. Army ARDEC					
Benet Laboratories, SMCAR-CCB-	TL		ARCCB-TR-94030		
Watervliet, NY 12189-4050					
			S COOK OR INC. MONITORING		
9. SPONSORING/MONITORING AGE	ENCY NAME(S) AND ADDRESS(ES) 11	O. SPONSORING MONITORING AGENCY REPORT NUMBER		
U.S. Army ARDEC					
Close Combat Armaments Center		i			
Picatinny Arsenal, NJ 07806-5000					
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11. SUPPLEMENTARY NOTES					
12a. DISTRIBUTION / AVAILABILITY	ETA TEMENT	1,	2b. DISTRIBUTION CODE		
12a. DISTRIBUTION / AVAILABILITY	STATEMENT	1'	20. DISTRIBUTION CODE		
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A failure analysis was performed on	several 120-mm morter hushings	and firing pins. The analysis	entailed examining (1) the failed firing		
pins and bushings for conformance	to drawing requirements, and (2) the	ne material differences between	en the U.Smade and the Israeli-made		
			ss determination, chemical composition		
determination, and scanning electron	n microscopy. The firing pins ess	entially met the required mate	erial specifications. However, it could		
			ecifications. There were no observable		
			nings did have a larger grain size, and		
the inner diameter of the bushing	showed a slight surface degradat	on and rougher topography	than the Israeli-made bushing. This		
difference in the inner diameter was	due to the machining process, wire	e electrical discharge machini	ing, that was used to produce the U.S		
made bushings.					
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14. SUBJECT TERMS		-	15. NUMBER OF PAGES		
Failure Analysis, 120-mm Mortar, V	Wire Electrical Discharge Machini	ng, Remelt	36		
			16. PRICE CODE		
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	18. SECURITY CLASSIFICATION	19. SECURITY CLASSIFICA OF ABSTRACT	TION 20. LIMITATION OF ABSTRACT		
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Form Approved
OMB No. 0704-0188

Public reporting burden for this collection of information is estimated to average 1 hour per response, including the time for reviewing instructions, searching existing data sources, gathering and maintaining the data needed, and completing and reviewing the collection of information. Send comments regarding this burden estimate or singular association to collection of information, including suggestions for reducing this burden, to Washington Headquarters Services, Directorate for information Operations and Reports, 1215 Lefferson Davis Highway, Suite 1204, Arlington, VA 22202-4302, and to the Office of Management and Budget, Paperwork Reduction Project (0704-0188). Washington, DC 20503.

Davis Highway, Suite 1204, Arrington, VA 222024		3. REPORT TYPE AND D	ATES COVERED
1. AGENCY USE ONLY (Leave blank,	August 1994	Final	
4. TITLE AND SUBTITLE RESIDUAL STRESS ANALYSIS IN SWAGE AUTOFRETTAGED THICK-WALLED CYLINDERS BY POSITION-SENSITIVE X-RAY DIFFRACTION TECHNIQUES			FUNDING NUMBERS AMCMS: 6111.02.H611.1
6. AUTHOR(S)			
S.L. Lee			
7. PERFORMING ORGANIZATION NA	ME(S) AND ADDRESS(ES)	8.	PERFORMING ORGANIZATION REPORT NUMBER
U.S. Army ARDEC Benét Laboratories, SMCAR-C Watervliet, NY 12189-4050	CB-TL		ARCCB-TR-94031
9. SPONSORING/MONITORING AGE	NCY NAME(S) AND ADDRESS(ES)	10	. SPONSORING / MONITORING
U.S. Army ARDEC Close Combat Armaments Cen Picatinny Arsenal, NJ 07806-50	ter	·	AGENCY REPORT NUMBER
11. SUPPLEMENTARY NOTES Presented at the ASME Internation the Proceedings of the Confe	erence.		olorado, 25-29 July 1993. Published 2b. DISTRIBUTION CODE
IZG. DISTRIBUTION / MYMICABILIT 3	A CO C PIRILETT		
Approved for public release; di	stribution unlimited.		
an outside diameter (OD) to in and angular stress distribution. Theoretical calculation was made an IBM PC. The model was be walled cylinder under internal indicated that non-axisymmetric between experimental results a experimental data with theoretic	vestigations were made for swage a side diameter (ID) ratio of 2.75 a around the bore were analyzed a de by implementing an interactive ased on the classical solution to to pressure, including reverse yielding to deformation had occurred during and theoretical predictions, inclu-	and 74 percent overstrain. using two position-sensitive, iterative Lotus Works space elastic-plastic deformance effect. Angular stress of yielding of the cylinders. It is a coverstrained cylinders, the overstrained cylinders, the	Residual stress radial distribution of x-ray diffraction stress analyzers. The additional residual stress model on the transition of a symmetric thick-distribution data at the ID and OD Excellent agreement was obtained feet near the bore. By comparing the Bauschinger factor for the A723 a suggested in the future.
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14 SUBJECT TERMS Residual Stress, Swage Autofn Position-Sensitive Stress Analy Pressure Vessel, Reverse Yield	zer, X-Ray Diffraction,		16. PRICE CODE
17. SECURITY CLASSIFICATION OF REPORT	18. SECURITY CLASSIFICATION OF THIS PAGE	19. SECURITY CLASSIFICATION OF ABSTRACT	ATION 20. LIMITATION OF ABSTRAC
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Form Approved
OMB No. 0704-0188

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1. AGENCY USE ONLY (Leave blan		3. REPORT TYPE AND	DATES COVERED
	August 1994	Final	
4. TITLE AND SUBTITLE FRACTURE ASSESSMENT OF 15	AMCMS No. 6111.02.H611.1 PRON No. 1A11Z1CANMBJ		
6. AUTHOR(S)			
E. Troiano, J.H. Underwood, and R	T. Abbott		
7. PERFORMING ORGANIZATION NA	AME(S) AND ADDRESS(ES)	. 8	. PERFORMING ORGANIZATION REPORT NUMBER
U.S. Army ARDEC	_		
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Watervliet, NY 12189-4050		·	
9. SPONSORING/MONITORING AGE	ENCY NAME(S) AND ADDRESS(ES) 1	0. SPONSORING / MONITORING
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11. SUPPLEMENTARY NOTES			
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12a. DISTRIBUTION / AVAILABILITY	STATEMENT	T.	2b. DISTRIBUTION CODE
Distribution limited to U.S. Governs critical technology; August 1994. (to Commander, U.S. Army Armand ATTN: Benet Laboratories, SMCA	Other requests for this document nent Research, Development, and E	nust be referred ngineering Center	• ,
13. ABSTRACT (Maximum 200 word	(s)		
The subject breech ring, Serial No. possessed fatigue lives ranging from	1659, was the sixth to be tested in 4444 to 6214 cycles-to-failure a fashion after only 109 cycles. M	out of a population of six. (N _t). This particular ring, to echanical and fracture tought	The previous five breech rings tested sted under the same conditions as the ness testing of Serial No. 1659 revealed of fracture toughness.
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Form Approved
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Davis Highway, Suite 1204, Arlington, VA 22202	2-4302, and to the Office of Management and		
1. AGENCY USE ONLY (Leave blan	k) 2. REPORT DATE	3. REPORT TYPE A	ND DATES COVERED
	August 1994	Final	Le cumpue muserae
4. TITLE AND SUBTITLE ADAPTIVE FINITE ELEME SOLUTION ALGORITHM 6. AUTHOR(S)	5. FUNDING NUMBERS PRON: 1A323F2TA11A AMCMS: 612624H181100		
J.M. Coyle and J.E. Flaherty			·
7. PERFORMING ORGANIZATION N	AME(S) AND ADDRESS(ES)		8. PERFORMING ORGANIZATION REPORT NUMBER
U.S. Army ARDEC Benét Laboratories, SMCAR- Watervliet, NY 12189-4050	CCB-TL		ARCCB-TR-94033
9. SPONSORING / MONITORING AG	ENCY NAME(S) AND ADDRESS(E	5)	10. SPONSORING / MONITORING
U.S. Army ARDEC Close Combat Armaments Ce Picatinny Arsenal, NJ 07806-5	nter		AGENCY REPORT NUMBER
11. SUPPLEMENTARY NOTES			
12a. DISTRIBUTION / AVAILABILITY	STATEMENT		12b. DISTRIBUTION CODE
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13. ABSTRACT (Maximum 200 word	is)		
An adaptive finite element met differential equations in one sp finite element approximations, inexpensive approximation to successively higher orders to ob- are used to control an adaptive depending on the dominant of mesh movement has been wr	thod is developed to solve initial ace dimension and time. The diffunction Superconvergence properties at the spatial component of the errotain an approximation of the term mesh refinement strategy. Reproponent of the error estimate.	ferential equations are di and quadratic polynomia for. This technique is con apporal and total discretize finement is performed A computer code coup of problems. These co	is for vector systems of parabolic partial iscretized in space using piecewise linear als are used to derive a computationally pupled with time integration schemes of eation errors. These approximate errors in space, time, or both space and time oling this refinement strategy and stable emputations confirm that proper mesh
14. SUBJECT TERMS Parabolic Differential Equation Error Estimation, Mesh Refin	ons, Adaptive Finite Elements, S ement, Mesh Movement	Superconvergence,	15. NUMBER OF PAGES 51 16. PRICE CODE
17. SECURITY CLASSIFICATION OF REPORT	18. SECURITY CLASSIFICATION OF THIS PAGE	19. SECURITY CLASSI OF ABSTRACT	FICATION 20. LIMITATION OF ABSTRACT
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Form Approved

OMB No. 0704-0188

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1. AGENCY USE ONLY (Leave blan	nk) 2. REPORT DATE	3. REPORT TYPE AN	D DATES COVERED
	September 1994	Final	
4. TITLE AND SUBTITLE ADAPTIVE FINITE ELEME ERROR ESTIMATION	5. FUNDING NUMBERS AMCMS: 612624H191.0		
6. AUTHOR(S)			
J.M. Coyle and J.E. Flaherty			
July Coyle and J.L. Hancity			
7. PERFORMING ORGANIZATION N	AME(S) AND ADDRESS(ES)		8. PERFORMING ORGANIZATION REPORT NUMBER
U.S. Army ARDEC Benét Laboratories, SMCAR-	CCR.TT		ARCCB-TR-94034
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Picatinny Arsenal, NJ 07806-5	000	·	
11. SUPPLEMENTARY NOTES			
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differential equations in one spa finite element approximations. inexpensive approximation to t	ace dimension and time. The Superconvergence properti he spatial component of the btain an approximation of the	differential equations are disc es and quadratic polynomials error. This technique is coup ne temporal and total discreti	for vector systems of parabolic partial retized in space using piecewise linear are used to derive a computationally oled with time integration schemes of zation errors. Computational results sh is refined.
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14 SUBJECT JERMS Parabolic Differential Equation	ns. Adaptive Finite Flement	s Finite Differences	15. NUMBER OF PAGES 25
Superconvergence, Error Estin	nation, Error Decomposition]	
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17. SECURITY CLASSIFICATION OF REPORT	18. SECURITY CLASSIFICATION OF THIS PAGE	ON 19. SECURITY CLASSIFI OF ABSTRACT	CATION 20. LIMITATION OF ABSTRACT
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Form Approved
OMB No. 0704-0188

Public reporting burden for this collection of information is estimated to average. I hour per response, including the time for reviewing instructions, searching existing data sources, gathering and maintaining the data needed, and completing and reviewing the collection of information. Send comments regarding this burden estimate or any other aspect of this collection of information, including suggestions for reducing this burden. Washington Headquarters Services, Directorate for information Operations and Reports, 1215 Jefferson Davis Highway, Suite 1204, Arlington, VA. 22202-4302, and to the Office of Management and Budget, Page-revork Reduction Project (0704-01393). Washington, DC 20503.

	24302, and to the Office of Management and	<u> </u>			
1. AGENCY USE ONLY (Leave black	nk) 2. REPORT DATE	3. REPORT TYPE AND	DATES COVERED		
	September 1994	Final			
4. TITLE AND SUBTITLE FAILURE ANALYSIS OF 120-MI SERIAL NO. 2416	5. FUNDING NUMBERS AMCMS No. 6126.24.H180.0				
6. AUTHOR(S)					
Kathryn E. Noll and John R. Senic	k, Jr.				
7. PERFORMING ORGANIZATION N	AME(S) AND ADDRESS(ES)		8. PERFORMING ORGANIZATION		
U.S. Army ARDEC			REPORT NUMBER		
Benet Laboratories, SMCAR-CCB-	-TL		ARCCB-TR-94035		
Watervliet, NY 12189-4050					
9. SPONSORING/MONITORING AG	ENCY NAME(S) AND ADDRESS(ES)	10. SPONSORING / MONITORING		
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Close Combat Armaments Center					
Picatinny Arsenal, NJ 07806-5000					
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11. SUPPLEMENTARY NOTES					
11. SUPPLEMENTARY NOTES					
12a. DISTRIBUTION / AVAILABILITY			12b. DISTRIBUTION CODE		
Distribution limited to Department of Defense only because of premature dissemination; September 1994. Other requests for this document must be referred to Commander, U.S. Army Armament Research, Development, and Engineering Center, ATTN: Benet Laboratories, SMCAR-CCB-SE, Watervliet, NY 12189-4050.					
13. ABSTRACT (Maximum 200 words)					
firing kinetic energy training ammus microscopy, metallographic examin	nition. The analysis included visual nation, and chemical composition do. No evidence of pre-existing flaw.	examination, mechanical partermination. Based on the	experienced a muzzle end failure while roperty determination, scanning electron e analysis, the gun tube material met or e surface. The most probable cause for		
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14. SUBJECT TERMS			15. NUMBER OF PAGES		
Gun Tube Failure, Shear Fracture,	Microvoid Coalescence, 120-mm N	1256 Gun Tube	25		
			16. PRICE CODE		
17. SECURITY CLASSIFICATION OF REPORT	18. SECURITY CLASSIFICATION OF THIS PAGE	19. SECURITY CLASSIFIC OF ABSTRACT	ATION 20. LIMITATION OF ABSTRACT		
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Form Approved
OMB No. 0704-0188

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1. AGENCY USE ONLY (Leave blan	September 1994	3. REPORT TYPE AND DAT Final	ES COVERED		
4. TITLE AND SUBTITLE EXPERIMENTAL METHOD MEASUREMENT USING A SINGLE-EXPOSURE SCINT		NDING NUMBERS AMCMS: 6111.02.H611.1 PRON: 1A12Z1CANMBJ			
6. AUTHOR(S)					
S.L. Lee, M. Doxbeck, and G.	P. Capsimalis				
7. PERFORMING ORGANIZATION N U.S. Army ARDEC Benét Laboratories, SMCAR-0 Watervliet, NY 12189-4050		RE	RFORMING ORGANIZATION PORT NUMBER ARCCB-TR-94036		
9. SPONSORING/MONITORING AG	ENCY NAME(S) AND ADDRESS(ES)		ONSORING / MONITORING		
U.S. Army ARDEC Close Combat Armaments Cer Picatinny Arsenal, NJ 07806-50		A	GENCY REPORT NUMBER		
11. SUPPLEMENTARY NOTES					
12a. DISTRIBUTION / AVAILABILITY	STATEMENT	12b.	DISTRIBUTION CODE		
Approved for public release; d		 			
13. ABSTRACT (Maximum 200 word	(s)	LLL			
In the Denver D-1000-A single-exposure position-sensitive scintillation detection (PSSD) system, surface residual stress measurement in any chosen direction is based on crystalline plane spacings determined in two directions normal to the surface made simultaneously in a single psi tilt. This technical allows fast, noncontacting, and nondestructive biaxial stress analysis. In this report, system performance is characterized by studying the noise, gain, and diffraction peak profiles as a function of diode array element. A four-point bend experiment was performed to determine the elastic constant of the 211 plane of body-centered cubic martensitic steel. Residual stress measurements were performed in several steel specimens and compared to measurements made on a similar system at Pennsylvania State University. Local software development allowed the single-exposure PSSD to run in a multiple-exposure mode for improved accuracy in biaxial stress analysis.					
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14. SUBJECT TERMS Residual Stress, Biaxial Stress, Single-Exposure Technique	itive Scintillation Detector,	15. NUMBER OF PAGES 27 16. PRICE CODE			
17. SECURITY CLASSIFICATION OF REPORT	18. SECURITY CLASSIFICATION OF THIS PAGE	19. SECURITY CLASSIFICATION	20. LIMITATION OF ABSTRACT		
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OMB No. 0704-0188

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	02-4302, and to the Office of Management an	d Budget, Paperwork Reduction Proje	ect (0704-0188), Washington, DC 20503			
1. AGENCY USE ONLY (Leave bla		3. REPORT TYPE AND	DATES COVERED			
4. TITLE AND SUBTITLE	September 1994	Final	5. FUNDING NUMBERS			
CHROMIUM PLATING AND EI ANALYSES BY ONLINE X-RAY	AMCMS No. 6126.24.H181.1					
6. AUTHOR(S)						
Samuel Sopok			·			
7. PERFORMING ORGANIZATION N	NAME(S) AND ADDRESS(ES)		8. PERFORMING ORGANIZATION REPORT NUMBER			
U.S. Army ARDEC Benet Laboratories, SMCAR-CCB Watervliet, NY 12189-4050	I-TL		ARCCB-TR-94037			
9. SPONSORING/MONITORING AG U.S. Army ARDEC Close Combat Armaments Center Picatinny Arsenal, NJ 07806-5000		S)	10. SPONSORING MONITORING AGENCY REPORT NUMBER			
11. SUPPLEMENTARY NOTES	11. SUPPLEMENTARY NOTES					
12a. DISTRIBUTION / AVAILABILITY			12b. DISTRIBUTION CODE			
Approved for public release; distri	bution unlimited.					
13. ABSTRACT (Maximum 200 words)						
Two increasingly important issues for the chemical processing industry are product quality and productivity. Traditionally, offline chemical analysis has been used to monitor both. The main disadvantage of offline analysis is the loss of time due to sampling, bringing samples to a lab, and waiting for results. Obvious efficiencies can be realized by continuous online chemical monitoring. The initial investment is high, but the return on investment can be very efficient process performance. X-ray fluorescence spectroscopy (online and offline) is investigated and evaluated as a means to quantitatively analyze metal finishing solutions such as actual chromium plating and electroplating solutions for chromium, sulfur, phosphorus, and iron. The identical experiment was conducted at three different manufacturers of this type of instrument, and included calibration, standardization, and analysis. Although this work has a specific objective related to chromium plating and electropolishing liquid samples, much information is related to and provided for other types of samples. Chemical analysis by x-ray fluorescence spectroscopy is nondestructive, applicable to multiple process streams (liquid or solid), and requires no dilutions. In addition, calibration, standardization, and maintenance are minimal. For the specific metal finishing applications discussed, the resultant data do not suggest that this online monitoring technique is useful at this time, but future work may show this technique to be practical.						
14. SUBJECT TERMS			15. NUMBER OF PAGES			
Chemical Analysis, X-Ray Fluores	scence, Online Analysis, Liquid Sa	imples.	26			
Solid Samples, Chromium Plating Chromium Analysis, Sulfur Analys	Solutions, Electropolishing Solution	ons,	16. PRICE CODE			
17. SECURITY CLASSIFICATION OF REPORT	18. SECURITY CLASSIFICATION OF THIS PAGE	19. SECURITY CLASSIFIC	ATION 20. LIMITATION OF ABSTRACT			
UNCLASSIFIED	UNCLASSIFIED	UNCLASSIFIED	UL			

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OMB No. 0704-0188

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Davis Highway, Suite 1204, Arlington, VA 22202	-4302, and to the Office of Management and	I Budget, Paperwork Reduction Proje	ct (0704-0188), Washington, DC 20503.		
1. AGENCY USE ONLY (Leave blan	k) 2. REPORT DATE	3. REPORT TYPE AND	DATES COVERED		
·	September 1994	Final			
4. TITLE AND SUBTITLE FATIGUE LIFE ANALYSIS CYLINDERS INCLUDING E AXIAL GROOVES 6. AUTHOR(S) J.H. Underwood and A.P. Parat Newcastle, UK)	5. FUNDING NUMBERS AMCMS: 6111.02.H611.1 PRON: 1A11Z1CANMBJ				
7. PERFORMING ORGANIZATION N	AME(S) AND ADDRESS(ES)		8. PERFORMING ORGANIZATION		
U.S. Army ARDEC Benét Laboratories, SMCAR-0 Watervliet, NY 12189-4050	CCB-TL		ARCCB-TR-94038		
9. SPONSORING/MONITORING AGE	NCY NAME(S) AND ADDRESS(E	5)	10. SPONSORING / MONITORING		
U.S. Army ARDEC Close Combat Armaments Cer Picatinny Arsenal, NJ 07806-50			AGENCY REPORT NUMBER		
11. SUPPLEMENTARY NOTES		- 			
Presented at the ASME Pressur Published in the ASME Journal		polis, MN, 19-23 June 199	4.		
12a. DISTRIBUTION / AVAILABILITY	STATEMENT		12b. DISTRIBUTION CODE		
Approved for public release; d					
13. ABSTRACT (Maximum 200 words)					
and with one or several semi-el root of the groove was calcula conditions. Comparisons were which cannon firing tests were failure in the laboratory. The description of the crack growt	liptical-shaped axial grooves at ted for various cylinder, groove made with fatigue crack growth first performed to produce axial life analysis, with an initial crack and fatigue life of the tests tant and configurational effects	he inner diameter. The far, and crack configurations and laboratory life results erosion grooves, followed a size based on the expect for cylinders with and with on the fatigue life design	cylinders autofrettaged by overstrain atigue life for a crack initiating at the s and for different material yielding from A723 thick-walled cylinders in by cyclic hydraulic pressurization to ted pre-existing defects, gave a good thout grooves. General fatigue life of overstrained cylinders, including d initial crack size.		
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14. SUBJECT TERMS			15. NUMBER OF PAGES		
Fatigue Life Analysis, Thick-W Erosion, Autofrettage, Residua		ration, Fatigue Tests,	17 16. PRICE CODE		
17. SECURITY CLASSIFICATION OF REPORT	18. SECURITY CLASSIFICATION OF THIS PAGE	19. SECURITY CLASSIFIC OF ABSTRACT	ATION 20. LIMITATION OF ABSTRACT		
UNCLASSIFIED	UNCLASSIFIED	UNCLASSIFIED	UL.		

Form Approved
OMB No. 0704-0188

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1. AGENCY USE ONLY (Leave blank	1	3. REPORT TYPE AND	DATES COVERED
	October 1994	Final	. FUNDING NUMBERS
4. TITLE AND SUBTITLE MONITOR FOR STATUS EPILEPT	ICUS SEIZURES	}	AMCMS No. 6111.02.H611.1 PRON No. 1A13Z1CANMBJ
6. AUTHOR(S)			
Mark Johnson and Thomas Simkins			
7. PERFORMING ORGANIZATION NA	AME(S) AND ADDRESS(ES)	8	. PERFORMING ORGANIZATION
U.S. Army ARDEC Benet Laboratories, AMSTA-AR-CO Watervliet, NY 12189-4050			ARCCB-TR-94039
9. SPONSORING / MONITORING AGE	NCY NAME(S) AND ADDRESS(ES)		0. SPONSORING / MONITORING
U.S. Army ARDEC Close Combat Armaments Center Picatinny Arsenal, NJ 07806-5000			AGENCY REPORT NUMBER
11. SUPPLEMENTARY NOTES Presented at Technology 2003, Four Published in Proceedings of Techno			
12a. DISTRIBUTION / AVAILABILITY	STATEMENT		26. DISTRIBUTION CODE
Approved for public release; distribu	ution unlimited.		
13. ABSTRACT (Maximum 200 word	is)		
status epilepticus. It is a condition epilepsy does not follow the typical The mortality rate is high without provides an inexpensive solution to been designed as a cooperative research Engineering Center's Benet Labor Department of Neurology at Albany	that affects approximately 3 to 5 p cycle of start-peak-end. The convul- rompt medical treatment at a suitable the needs of those responsible for the arch and development effort involviratories (Benet) and the Cerebral In Medical College (AMC). Benet h	ercent of those individuals assons continue until medical facility. The report describe care of individuals afflicting the United States Army and Calsy Center for the Disales delivered a working pro-	ct the onset of a seizure disorder called suffering from epilepsy. This form of ally interrupted and are life-threatening, ibes the details of a monitor design that and with this disorder. The monitor has Armament Research, Development, and oled (Center), in association with the cotype of the device for field testing, in monitoring and has agreed to pursue
14. SUBJECT TERMS			15. NUMBER OF PAGES
Neuronetworks, Epilepsy, Status Ep	pilepticus, Monitors		9 16. PRICE CODE
		40 858110101 41 4 44-1-	ATION 20. LIMITATION OF ABSTRACT
17. SECURITY CLASSIFICATION OF REPORT UNCLASSIFIED	18. SECURITY CLASSIFICATION OF THIS PAGE UNCLASSIFIED	19. SECURITY CLASSIFIC OF ABSTRACT UNCLASSIFIED	UL
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1. AGENCY USE ONLY (Leave blan	nk) 2. REPORT DATE	3. REPORT TYPE AND DATES	OVERED		
	October 1994	Final			
4. TITLE AND SUBTITLE			NG NUMBERS		
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6. AUTHOR(S)					
David H. Honsinger		·			
7. PERFORMING ORGANIZATION N	AME(S) AND ADDRESS(ES)		ORMING ORGANIZATION RT NUMBER		
U.S. Army ARDEC Benet Laboratories, AMSTA-AR-C Watervliet, NY 12189-4050	CCB-O	ARG	CCB-MR-94040		
9 SPONSORING/MONITORING AG	ENCY NAME(S) AND ADDRESS(ES)	10. SPON	ISORING / MONITORING		
		AGE	ICY REPORT NUMBER		
U.S. Army ARDEC Close Combat Armaments Center Picatinny Arsenal, NJ 07806-5000					
11. SUPPLEMENTARY NOTES					
		142h DIS	TRIBUTION CODE		
12a. DISTRIBUTION / AVAILABILITY	STATEMENT	120. Dis	TRIBUTION CODE		
Approved for public release; distrib	oution unlimited.				
200					
13. ABSTRACT (Maximum 200 words)					
standards, authorized for use by the is based on a comparison of the defi	ing of the symbolically represented to Department of Defense and the U.S ined meaning in each of these standar and the associated tolerance has, in a tibed.	 Army in the preparation of engired as it relates to the defined meaning 	eering drawings. The analysis ng in the most current standard.		
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14. SUBJECT TERMS			15. NUMBER OF PAGES		
Geometric, Dimensioning, Toleran	cing		16. PRICE CODE		
17. SECURITY CLASSIFICATION OF REPORT	18. SECURITY CLASSIFICATION OF THIS PAGE	19. SECURITY CLASSIFICATION OF ABSTRACT	20. LIMITATION OF ABSTRACT		
UNCLASSIFIED	UNCLASSIFIED	UNCLASSIFIED	UL		

Form Approved CMB No. 0704-0188

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1. AGENCY USE ONLY (Leave bla	ank)	2. REPORT DATE	3. REPORT TYPE AND DATES COVERED			
·		October 1994	Final			
4. TITLE AND SUBTITLE		,		5. FUND	DING NUMBERS	
A FRACTURE MECHANICS AS					CMS No. 6111.02.H611.1	
THE 155-MM M284 MUZZLE BRAKE			PRO	ON No. 1A11Z1CANMBJ		
6. AUTHOR(S)			·	4		
6. AUTHOR(3)						
Robert R. Fujczak and Joseph A. 1	Kapp					
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7. PERFORMING ORGANIZATION	NAME(S) AND ADDRESS(ES)		8. PERF	ORMING ORGANIZATION	
U.S. Army ARDEC	•	•			RT NUMBER	
Benet Laboratories, AMSTA-AR-	CCB-O	•		AR.	CCB-TR-94041	
Watervliet, NY 12189-4050					333 1312	
9. SPONSORING/MONITORING AC	GENCY	NAME(S) AND ADDRESS(ES)		NSORING/MONITORING NCY REPORT NUMBER	
U.S. Army ARDEC				1 ~	NET REPORT HOWIDER	
Close Combat Armaments Center						
Picatinny Arsenal, NJ 07806-5000)					
11. SUPPLEMENTARY NOTES						
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12a. DISTRIBUTION / AVAILABILITY	STAT	EMENT		12b. DIS	TRIBUTION CODE	
Distribution limited to Department	t of De	fense and Department of Def	ense contractors			
because of critical technology; Oct	tober 1	994. Other requests for this	document must be			
referred to Commander, U.S. Arm	y Arm	ament Research, Developmer	t, and Engineering			
Center, AllN: Benet Laboratorie	Center, ATTN: Benet Laboratories, AMSTA-AR-CCB-TB, Watervliet, NY 12189-4050.					
13. ABSTRACT (Maximum 200 words)						
A fracture mechanics analysis was	s condu	acted to determine the conder	nnation life assessment	of the 155-	mm M284 muzzle brake. The	
original assessment was found to b	e too c	onservative for a proper eval	nation of fatigue life, be	sed on a low	estimate of fracture toughness	
derived from previous muzzle bra replacement of the muzzle brake a	ake ma	erv second our tube change	s proved to be very a	ccurate in p	redicting safe fatigue life and	
ropiasoman of the mazze brake a	uwi cv	cry second guir tube change,	dieteby saving conside	rably on muz	zie brake replacement.	
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14. SUBJECT TERMS					15. NUMBER OF PAGES	
Muzzle Brake, Fracture Toughness	s, Fatig	ue Life, In-House Inspection	Field Condemnation		26	
					16. PRICE CODE	
17. SECURITY CLASSIFICATION	10 -	ECHIDITY OF ACCIDICATION	10 CECUDITY CLASS	IEICATION	20 LIMITATION OF ADOTTORS	
OF REPORT		SECURITY CLASSIFICATION OF THIS PAGE	19. SECURITY CLASS OF ABSTRACT	arica HUN	20. LIMITATION OF ABSTRACT	
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1. AGENCY USE ONLY (Leave blank)	2. REPORT DATE	3. REPORT TYPE A	ND DATES	COVERED	
<u> </u>	November 1994	Final			
MATERIALS CHARACTERIZATION OF HARD				E. FUNDING NUMBERS AMCMS No. 6126.24.H180.0 PRON No. 470TEV64471A	
6. AUTHOR(S)			7		
Kathryn E. Noll					
7. PERFORMING ORGANIZATION NAME	(S) AND ADDRESS(ES)	···		ORMING ORGANIZATION	
U.S. Army ARDEC	_	•		RT NUMBER	
Benet Laboratories, AMSTA-AR-CCB-C Watervliet, NY 12189-4050)		ARC	CB-TR-94042	
Water viiet, 14.1 12.169-40.50					
9. SPONSORING / MONITORING AGENCY	NAME(S) AND ADDRESS(ES)		SORING MONITORING	
U.S. Army ARDEC			1		
Close Combat Armaments Center Picatinny Arsenal, NJ 07806-5000					
11. SUPPLEMENTARY NOTES			<u> </u>		
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12a. DISTRIBUTION / AVAILABILITY STAT	TEMENT	· · · · · · · · · · · · · · · · · · ·	12b. DIS	TRIBUTION CODE	
Distribution limited to U.S. Government evaluation; November 1994. Other required Commander, U.S. Army Armament Research: Benet Laboratories, AMSTA-All	ests for this document must earch, Development, and En	be referred to gineering Center,			
13. ABSTRACT (Maximum 200 words)			<u> </u>		
A materials characterization was perform analysis were sectioned from gun tube characterization compared chromium pla (2) HC versus LC chromium, and (3) is examination, metallographic examination electron microscopy. Muzzle versus bre while a slight variation was observed in morphology. There were no observable	es electroplated in the veste morphology and propertic HC plated in the vessel plant, microhardness evaluation, sech and hardness values were the microstructure. The HC	sel plating and production es for (1) breech versus musting versus production factor, array diffraction, chemical ere found to vary significant and LC chromium also discontinuous discontinuous control of the control facilities zzle end of cilities. The composition ty within isplayed lar	at Watervliet Arsenal. The fan LC chromium plated tube, as analysis consisted of visual on determination, and scanning the LC chromium plated tube,		
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14. SUBJECT TERMS				15. NUMBER OF PAGES	
Hard Chromium Low Contraction Chron	mium Veccal Disting Micro	aceackina		21	

NSN 7540-01-280-5500

UNCLASSIFIED

17. SECURITY CLASSIFICATION OF REPORT

Standard Form 298 (Rev. 2-89)
Prescribed by ANSI Std 239-18
298-102

20. LIMITATION OF ABSTRACT

16. PRICE CODE

19. SECURITY CLASSIFICATION OF ABSTRACT

UNCLASSIFIED

18. SECURITY CLASSIFICATION OF THIS PAGE

UNCLASSIFIED

Form Approved
OMB No. 0704-0188

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1. AGENCY USE ONLY (Leave blank)	2. REPORT DATE	3. REPORT TYPE AND	DATES COVERED		
	November 1994	Final	·		
4. TITLE AND SUBTITLE PARALLEL PARTITIONING STRATE			FUNDING NUMBERS PRON No. 6111.02.H611.1		
ADAPTIVE SOLUTION OF CONSERV	VATION LAWS				
6. AUTHOR(S)					
Karen D. Devine (RPI, Troy, NY), Jose Raymond M. Loy (RPI), and Stephen R		•			
Laboratories, Albuquerque, NM)					
7. PERFORMING ORGANIZATION NAME U.S. Army ARDEC	(S) AND ADDRESS(ES)	[PERFORMING ORGANIZATION REPORT NUMBER		
Benet Laboratories, AMSTA-AR-CCB-0	D .		ARCCB-TR-94043		
Watervliet, NY 12189-4050	-		I II.OOD I II. 7 TOTO		
9. SPONSORING / MONITORING AGENCY	Y NAME(S) AND ADDRESS(ES)		10. SPONSORING / MONITORING AGENCY REPORT NUMBER		
U.S. Army ARDEC		İ	Addition No.		
Close Combat Armaments Center Picatinny Arsenal, NJ 07806-5000		İ			
11. SUPPLEMENTARY NOTES					
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12a. DISTRIBUTION / AVAILABILITY STA	TEMENT		12b. DISTRIBUTION CODE		
Approved for public release; distribution	n unlimited.				
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13. ABSTRACT (Maximum 200 words) We describe and examine the performance of adaptive methods for solving hyperbolic systems of conservation laws on massively parallel					
computers. The differential system is a piecewise polynomial basis for the spatial	approximated by a discontinuo al discretization. Fluxes at elem	us Galerkin finite element ent boundaries are comput	method with a hierarchical Legendre ed by solving an approximate Riemann		
problem; a projection limiter is applied to and a p-refinement-based error estimate	is used as an enrichment indica	otone; time discretization is itor. Adaptive order (n-) as	performed by Kunge-Kutta integration; and mesh (h-) refinement algorithms are		
presented and demonstrated. Using an e	element-based dynamic load bal	lancing algorithm called til	ing and adaptive p-refinement, parallel		
efficiencies of over 60% are achieved on strategy for three-dimensional octree-stru	a 1024-processor nCUBE/2 hypuctured meshes. This method pr	ercube. We also demonstra oduces partition quality con	te a fast, tree-based parallel partitioning mparable to recursive spectral bisection		
at a greatly reduced cost.	•	• •	•		
		•			
14. SUBJECT TERMS Adaptive Methods, Hyperbolic Systems	of Conservation Laws Massis	ely Parallel	15. NUMBER OF PAGES 30		
Computation, Galerkin Finite Element N			16. PRICE CODE		
Load Balancing, Tiling, Domain Decom	position, Octree-Derived Mesh	es			
17. SECURITY CLASSIFICATION 18. OF REPORT	SECURITY CLASSIFICATION OF THIS PAGE	19. SECURITY CLASSIFICATION OF ABSTRACT	ATION 20. LIMITATION OF ABSTRACT		
UNCLASSIFIED UNC	CLASSIFIED	UNCLASSIFIED	ա և		

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OMB No 0704-0188

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1. AGENCY USE ONLY (Leave blan	k) 2. REPORT DATE November 1994	3. REPORT TYPE AND DA	ATES COVERED			
			FUNDING NUMBERS AMCMS: 6126.24.H180.0 PRON: M02B2FR21ABJ			
6. AUTHOR(S) P.J. Cote, T. Hickey, and M.D	. Witherell					
7. PERFORMING ORGANIZATION N. U.S. Army ARDEC Benét Laboratories, AMSTA-A Watervliet, NY 12189-4050			PERFORMING ORGANIZATION REPORT NUMBER ARCCB-TR-94044			
9. SPONSORING/MONITORING AGE U.S. Army ARDEC Close Combat Armaments Cer Picatinny Arsenal, NJ 07806-50	nter .	10.	SPONSORING / MONITORING AGENCY REPORT NUMBER			
11. SUPPLEMENTARY NOTES		•				
12a. DISTRIBUTION / AVAILABILITY Approved for public release; d		128	s. DISTRIBUTION CODE			
13. ABSTRACT (Maximum 200 words) A thermomagnetic analyzer was fabricated to provide in-situ monitoring of isothermal decompositions of austenite in steels and related alloys. The analyzer provides a convenient and rapid means for establishing time-temperature-transformation characteristics of a ferrous alloy by cycling a given specimen through a series of thermal treatments and monitoring the transformations magnetically. The present report describes the apparatus and gives results on the transformation characteristics of austempered ductile iron (ADI). This analyzer was also used to investigate alternative processing procedures; the results indicate that an improved heat treatment is available for large ADI components.						
14_SUBJECT TERMS Thermomagnetic Analysis, Aus Bainite	stempered Ductile Iron, Transfor	mations, Austenite, Ferrite,	15. NUMBER OF PAGES 14 16. PRICE CODE			
OF REPORT	18. SECURITY CLASSIFICATION OF THIS PAGE	19. SECURITY CLASSIFICAT OF ABSTRACT				
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Form Approved
OMB No. 0704-0188

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1. AGENCY USE ONLY (Leave blan	k) 2. REPORT DATE	3. REPORT TYPE AND D	ATES COVERED
	December 1994	Final	
4. TITLE AND SUBTITLE AN HP-ADAPTIVE METHO FOR PARABOLIC SYSTEMS		5.	AMCMS: 611.02.H611.1
6. AUTHOR(S)			·
Joseph E. Flaherty (Rensselaer	r Polytechnic Institute, Troy, NY Peter K. Moore (Tulane Universi		
7. PERFORMING ORGANIZATION NA	AME(S) AND ADDRESS(ES)	8.	PERFORMING ORGANIZATION REPORT NUMBER
U.S. Army ARDEC Benét Laboratories, AMSTA-A Watervliet, NY 12189-4050	AR-CCB-O		ARCCB-TR-94045
9. SPONSORING/MONITORING AGE	NCY NAME(S) AND ADDRESS(ES)	10	. SPONSORING : MONITORING
U.S. Army ARDEC Close Combat Armaments Cer Picatinny Arsenal, NJ 07805-50	nter	·	AGENCY REPORT NUMBER
11. SUPPLEMENTARY NOTES			
Submitted to: SIAM Journal of	Scientific Computations		
12a. DISTRIBUTION / AVAILABILITY	STATEMENT	12	b. DISTRIBUTION CODE
Approved for public release; di	istribution unlimited		
13. ABSTRACT (Maximum 200 word	A.		
We describe an adaptive meth parabolic partial differential e hierarchical basis in space and s and temporal discretization e	od-of-lines hp-refinement algorith quations. Solutions are calculatingly-implicit Runge-Kutta (SIRI	ated using Galerkin's methods in time. A posterior estimates to control specifications.	one-dimensional vector systems of mod with a piecewise-polynomial eriori estimates of the local spatial patial and temporal enrichment. basic hp-refinement procedure.
14. SUBJECT JERMS Adaptive Reimement, Finite-E	lement Methods, A Posteriori E	rror Estimation	15. NUMBER OF PAGES 37
			16. PRICE CODE
17. SECURITY CLASSIFICATION OF REPORT	18. SECURITY CLASSIFICATION OF THIS PAGE	19. SECURITY CLASSIFICAT OF ABSTRACT	TION 20. LIMITATION OF ABSTRACT
UNCLASSIFIED	UNCLASSIFIED	UNCLASSIFIED	UL

Form Approved
OMB No. 0704-0188

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1. AGENCY USE ONLY (Leave blank	2. REPORT DATE	3. REPORT TYPE AND DATES COVERED	
	December 1994	Final	
STRESS CONCENTRATION, STRESS INTENSITY, AND FATIGUE CRACK GROWTH ALONG EVACUATORS OF PRESSURIZED, AUTOFRETTAGED TUBES		TIGUE ZED,	JNDING NUMBERS AMCMS: 6111.02.H611.1 PRON: 1A11Z1CANMBJ
6. AUTHOR(S)			ļ
A.P. Parker (University of Nortand J.H. Underwood	humbria at Newcastle, Newcastle		·
7. PERFORMING ORGANIZATION NA	ME(S) AND ADDRESS(ES)		ERFORMING ORGANIZATION EPORT NUMBER
U.S. Army ARDEC Benét Laboratories, AMSTA-A Watervliet, NY 12189-4050	AR-CCB-O	, "	ARCCB-TR-94046
9. SPONSORING/MONITORING AGE	NCY NAME(S) AND ADDRESS(ES)		PONSORING / MONITORING
U.S. Army ARDEC Close Combat Armaments Cen Picatinny Arsenal, NJ 07806-50	iter		AGENCY REPORT NUMBER
11. SUPPLEMENTARY NOTES			
12a. DISTRIBUTION / AVAILABILITY	STATEMENT	12b	DISTRIBUTION CODE
Approved for public release; d			
13. ABSTRACT (Maximum 200 word	9		
A stress analysis has been cond hole penetrating radially throug pressure was applied on the evaradial locations along the evacuator hole. Fatigue crack predictions indicate that the autofrettaged tube, it is locate influence on crack shape in autofresses upon fatigue lifetime description of such stresses. Finally	ucted on a pressurized, fully or party the wall. Pressure was applied acuator hole surfaces. Total hoo cuator and stress intensity factors growth rates, and hence crack predictical location for the crack in ad approximately halfway through the tothe autofrettage process has, the predicted profiles are compar predicted and actual lifetimes is	on the inside diameter (ID) p stress concentrations have have been determined alcofiles, were predicted at each a non-autofrettaged tube the wall thickness. Stress a limited effect upon lifeti been described and an insiged with experimental observ.	been determined for a range of ong a crack emanating from the ch of the radial locations. These is at the ID, whereas in a fully a ratio $\sigma_{\rm mb}/\sigma_{\rm max}$ has a significant me. The effect of axial residual mificant reduction in lifetime was ations of fatigue crack evacuators,
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14. SUBJECT TERMS Crack Growth, Fatigue Cracks Fracture Mechanics, Residual	s, Cylinders, Evacuators, Cross-Bo Stress, Stress Intensity Factor, Str	ore, Fracture (Materials), ress Ratio	15. NUMBER OF PAGES 24 16. PRICE CODE
		40 CECHOITY CLASSIFICATI	ON 20. LIMITATION OF ABSTRACT
17. SECURITY CLASSIFICATION OF REPORT	18. SECURITY CLASSIFICATION OF THIS PAGE	19. SECURITY CLASSIFICATI OF ABSTRACT	
UNCLASSIFIED	UNCLASSIFIED	UNCLASSIFIED	<u> </u>

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4. TITLE AND SUBTITLE			NG NUMBERS
REPORT OF VISITING SCIENTIST ATTACHMENT OF DR. ANTHONY P. PARKER OF UNIVERSITY OF NORTHUMBRIA, U.K. TO BENÉT LABORATORIES JULY - AUGUST 1994			MS: 6126.24.H180.0 N: 470TEV64471A
6. AUTHOR(S)		·	·
J.H. Underwood and A.P. Parke United Kingdom)	er (University of Northumbria at		
7. PERFORMING ORGANIZATION NA U.S. Army ARDEC	ME(S) AND ADDRESS(ES)		RMING ORGANIZATION T NUMBER
Benét Laboratories, AMSTA-Al Watervliet, NY 12189-4050	R-CCB-O	ARC	CCB-MR-94047
9. SPONSORING/MONITORING AGE	NCY NAME(S) AND ADDRESS(ES)	10. SPON	SORING / MONITORING
U.S. Army ARDEC		AGEN	CY REPORT NUMBER
Close Combat Armaments Cent Picatinny Arsenal, NJ 07806-500			
11. SUPPLEMENTARY NOTES	`		
12a. DISTRIBUTION / AVAILABILITY S	TATEMENT	12b. DIS	TRIBUTION CODE
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13. ABSTRACT (Maximum 200 words			
The results of a two-month vising Newcastle, United Kingdom to the are reported. A description is g	iting scientist attachment of Dr. he U.S. Army Armament Research iven of the arrangements for the hat give details of the results of the	n, Development, and Engineering visit, the technical topics address	Center, Benét Laboratories
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visiting Scientist, Fracture Med	chanics, Metal Patigue, Stress And	arysis, fressure vessels	16. PRICE CODE
	18. SECURITY CLASSIFICATION	19. SECURITY CLASSIFICATION OF ABSTRACT	20. LIMITATION OF ABSTRACT
OF REPORT UNCLASSIFIED	OF THIS PAGE UNCLASSIFIED	UNCLASSIFIED	UL

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	December 1	1994	Final		
4. TITLE AND SUBTITLE SPECTRAL CHARACTERIZATION ULTRASOUND USING NEURAL		-		1	ING NUMBERS IMS No. 6111.02.H611.1
6. AUTHOR(S)	****				
Mark A. Johnson, Michael A. Cipo	ollo, and R.D. Scan	lon		·	
7. PERFORMING ORGANIZATION N U.S. Army ARDEC Benet Laboratories, AMSTA-AR-O		RESS(ES)		REPO	DRMING ORGANIZATION RT NUMBER CB-TR-94048
Watervliet, NY 12189-4050				74.0	CB-1K-94040
9. SPONSORING/MONITORING AG	ENCY NAME(S) A	ND ADDRESS(ES)		ISORING / MONITORING
U.S. Army ARDEC Close Combat Armaments Center Picatinny Arsenal, NJ 07806-5000				AGEN	ICY REPORT NUMBER
11. SUPPLEMENTARY NOTES				L	
12a. DISTRIBUTION / AVAILABILITY	STATEMENT			12b. DIS	TRIBUTION CODE
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13. ABSTRACT (Maximum 200 work	ds)				
A novel nondestructive evaluation been abandoned because of the diff because of the complicated, noisy computation. These massively para a high degree of fault tolerance. T test equipment and producing output	iculty in interpretir , and incomplete allel systems providant his report discusses	ng the results. The nature of the declaration declaration is design of a new second control of the new second control of t	raditional analysis is incor ata. Neural networks pr to extract pertinent inform ral network system capab	nvenient to rovide a ra nation fron	apply to this type of problem adically different approach to n input data while maintaining
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17. SECURITY CLASSIFICATION OF REPORT	18. SECURITY CL OF THIS PAG		19. SECURITY CLASSIFI OF ABSTRACT	CATION	20. LIMITATION OF ABSTRACT
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4. TITLE AND SUBTITLE THE ELECTRODEPOSITION OF LOW CONTRACTION CHROMIUM/MOLYBDENUM ALLOYS USING PULSE-REVERSE PLATING		5. FUNDING NUMBERS AMCMS: 6111.02.H611.1	
6. AUTHOR(5) Mark D. Miller and Stephen Lange	iton		
7. PERFORMING ORGANIZATION NAME U.S. Army ARDEC Benét Laboratories, AMSTA-AR-0 Watervliet, NY 12189-4050			8. PERFORMING ORGANIZATION REPORT NUMBER ARCCB-TR-94049
9. SPONSORING/MONITORING AGENCY U.S. Army ARDEC Close Combat Armaments Center Picatinny Arsenal, NJ 07806-5000	NAME(S) AND ADDRESS(E	:5)	10. SPONSORING / MONITORING AGENCY REPORT NUMBER
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13. ABSTRACT (Maximum 200 words)

The use of modulated pulse periodic reverse (pulse-reverse) current to electrodeposit a low contraction (LC) chromium/molybdenum alloy has been evaluated. When using one full pulse-reverse plating cycle, the percent molybdenum in the deposit increased almost 400 percent (from 1 to 4 percent) as the current in the reverse cycle was increased from 0 to 10 amps. However, when the pulse-reverse current was carried to six full plating cycles, the percent molybdenum in the deposit was not dependent upon the current and remained constant at about 1 percent. This is about the same percent molybdenum that could be expected in direct current-plated LC chromium/molybdenum alloy and about half the percent molybdenum that could be expected in an on/off pulse-plated LC chromium/molybdenum alloy.

14. SUBJECT TERMS Molybdenum, Chromium, Ele	ectroplating, Electrodeposition, Po	ulse, Pulse-Reverse	15. NUMBER OF PAGES 12
			16. PRICE CODE
17. SECURITY CLASSIFICATION OF REPORT	18. SECURITY CLASSIFICATION OF THIS PAGE	19. SECURITY CLASSIFICATION OF ABSTRACT	20. LIMITATION OF ABSTRACT
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